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The Debiasing of Judgmental Errors Associated With Anxiety.

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THE DEBIASING OF JUDGMENTAL ERRORS ASSOCIATED WITH ANXIETY

A Dissertation

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Abstract

It was the goal of the current study to investigate one debiasing technique and its ability to reduce judgmental errors. In addition, a rival hypothesis of demand characteristics was examined as a possible explanation of any findings of the reduction of judgmental errors. Participants were randomly assigned to either a control group or a debiasing group and asked to rate the likelihood of several hypothetical events in a 2 X 2 X 2 X 2 (Gender X Anxiety Group X Treatment Group X Repeated Measure) repeated measures experimental design. Level of anxiety responsiveness was measured to arrange subjects into a "normal" and a highly anxious group. It was hypothesized that highly anxious participants would report higher probability estimates of future threat-related events relative to participants with a "normal" level of anxiety responsiveness, a main effect for anxiety. Secondly, it was hypothesized that a two-way interaction of treatment group and repeated measure upon threat probability ratings would be found. Third, it was hypothesized that a two-way interaction of gender and anxiety upon threat probability ratings would be found. Finally, it was hypothesized that there would be no main effects or interaction effects involving the repeated

measure and the experimental demand independent variable. A mixed factorial design 2 X 2 X 2 X 2 repeated measures ANOVA was conducted using the threat probability ratings as the dependent variable. In addition, two separate analyses were conducted using the experimental demand stimuli as the dependent variable to investigate demand characteristics as an explanation of the debiasing. The results showed that the debiasing procedure was effective in the reduction of judgmental errors. In addition, it was found that demand characteristics could not account for the reduction in pessimistic threat-related predictions. The results were discussed in terms of cognitive biases and implications for cognitive behavior therapy.

Introduction

The judgement of the likelihood of future events involves many processes other than the mental mathematical estimation of probabilities. Judgmental processes appear to involve the use of mental shortcuts, or heuristics. Heuristics function to aid in the estimation of the likelihood of future events in order to reduce the complexity of the estimation. As a result, errors in judgement can occur due to the reliance on these heuristics that reduce the need for complex calculations in favor of easily estimated judgements that are, at times, inaccurate.

One area of judgmental error that has received recent attention is the pessimistic prediction of future threat-related events associated with high levels of anxiety. Pessimistic errors in the estimation of the likelihood of future events have been found in anxious individuals (Bentz & Williamson, 1998; Bentz, Williamson, & Smith, 1999). Most investigators have postulated that a process of increased availability of threat-related information leads to this judgmental bias (Bentz & Williamson, 1998; Harvey, Richards, Dziadosz, & Swindell, 1993).

Research on the reduction of judgmental errors has attempted use techniques which increase the availability of alternative information (Hirt & Markman, 1995; Mumma & Wilson, 1995). However, the results are mixed in findings

of debiasing techniques that have attempted to reduce judgmental biases (Sharpe & Adair, 1993; Weinstein & Klien, 1995). In addition, no previous studies have specifically investigated the reduction of a pessimistic judgment bias associated with higher levels of anxiety.

It was the goal of this study to investigate one debiasing technique, the Consider-An-Alternative procedure (Hirt & Markman, 1995), and its ability to reduce the judgmental errors which have been shown to be associated with higher levels of anxiety (Bentz & Williamson, 1998). In addition, the rival hypothesis of demand characteristics was investigated as a possible explanation of any findings of a reduction in judgmental errors.

Cognitive Biases in Anxiety

Cognitive biases have been postulated to be an important component in the development and maintenance of anxiety (Beck & Clark, 1997; Bower, 1981; Lang, 1985; Mathews & Mackintosh, 1998). In addition, cognitive biases are important in our understanding of the mechanisms of debiasing. The current study will specifically address the debiasing of one type of cognitive bias, namely judgmental errors associated with anxiety.

Research on attentional biases, memory biases, and more recently, judgmental biases form the scientific basis for the understanding of how anxious persons develop

organized memory from the systematic selection of threat-related information. Each of these topics is discussed below. In addition, a conceptualization of cognitive biases is also reviewed, with an emphasis on cognitive models of anxiety.

Attentional Bias The attentional bias research has found that anxious persons allocate more attentional resources to threat-related stimuli. This research has established that anxiety is associated with the biased allocation of attention toward threat-related information. More recently, the study of attentional biases has moved toward the investigation of the processes of attention and their relation to the development and maintenance of anxiety disorders.

Studies that have investigated the relation between emotion and attention have generally used variations of three different paradigms: Stroop color-naming tasks, visual attention tasks, and dichotic listening tasks (MacLeod & Mathews, 1991). In the Stroop color-naming task, words are presented in different colors of ink. It is the task of the participant to name the color of the ink while ignoring the content of the word. Attention to the word meaning versus the color of ink is measured by the slowing of reaction times in naming of the color of ink. When investigating emotional states, the content of the

words presented are mood congruent, e.g. threat-related words for studying anxiety disorders.

Using the Stroop color-naming task, several studies have shown that anxious participants are significantly slower at naming the color of ink when the word content is threat-related in comparison to non-threat related words (Foa, Feske, McCarthy, Murdock, & Kozak, 1991; Mathews & MacLeod, 1985; McNally, Kaspi, Rienmann, & Zeitlin, 1990). In general, these studies have found that the color naming of threat-related words was slower due to the bias that exists in the selective allocation of attentional resources toward the threat-related information. For example, Mathews and MacLeod (1985) showed that anxious participants' reaction times in color naming are slower for threat words in comparison to non-threat words.

However, the Stroop paradigm had received some criticism. Specifically, it had been suggested that the Stroop paradigm may not provide an accurate measure of attention bias (Mineka & Sutton, 1992) due to the automaticity of reading. Specifically, it has been proposed that Stroop effects may be due to the ease with which words may be read and not due to an attentional bias (Kahneman & Chajczyk, 1983). The visual attention and dichotic listening tasks were developed in response to these criticisms.

Visual attention tasks involve the presentation of a variety of words on a computer screen, occasionally followed by a dot probe in the place of one of the words. The dot probe is simply a stimulus that cues the participant to respond. It is the task of the participant to respond to the probe as quickly as possible by simply pressing a key. Attention to the content of the presented words is obtained by measuring reaction times to the visual dot probe. Faster reaction times to the probe following a threat-related stimulus indicated increased attention to that stimulus. Similar to the Stroop paradigm, the visual attention studies have, in general, shown that anxiety is associated with a biased selective allocation of attentional resources toward threat (Logan & Goetsch, 1993; MacLeod, Mathews, & Tata, 1986).

Dichotic listening tasks involve the presentation of messages to the participant in each ear with the use of headphones. It is the responsibility of the participant to shadow, or attend to only one of the messages. A measure of attention is then obtained from the participants' recall of the content of the shadowed message. Similar to the two previous paradigms, the findings of the dichotic listening experiments have demonstrated selective attention toward threat in anxious groups (Logan & Geotsch, 1993; Mathews &

MacLeod, 1986) as indicated by increased recall of the threat information.

Thus, the research on an attentional bias in anxiety has documented a clear relation between anxious states and the biased allocation of attentional resources toward threat-related information. Recent studies have begun to investigate the processes of the attentional bias and its relation to the development and maintenance of anxiety disorders. For example, Kindt and Brosschot (1997) showed that there was no difference in the threat-related attentional bias for pictures and words. In addition, Kindt and Brosschot (1998) also demonstrated that the attentional bias for threat in anxiety is stable over time and responsive to experimental manipulation. McNally, Hornig, Hoffman, and Han (1999) suggested that the emergence of an attentional bias occurs after the development of clinical levels of anxiety.

In summary, the literature has shown a biased allocation of attentional resources toward threat-related information. Specifically, the attentional bias appears to be a stable phenomena responsive to experimental manipulation that may emerge after the development of clinical levels of anxiety.

Memory Bias In general, a memory bias in anxiety deals with the selective encoding, elaboration, and

retrieval of threat-related information. A memory bias for threat-related words has been demonstrated in post-traumatic stress disorder (Zeitlin & McNally, 1991), panic disorder (Cloitre & Lebowitz, 1991; McNally, Foa, & Donnell, 1989), and anxiety states (Mathews, Mogg, May, & Eysenck, 1989). In general, these studies have shown that anxious individuals have an enhanced recall of threat-related words in comparison to control groups.

However, not all investigations of memory bias in anxiety have produced supportive findings. Nugent and Mineka (1994) failed to find an implicit memory bias in students with a high level of trait anxiety. In addition, in their review of cognitive biases in emotional disorders, Mineka and Sutton (1992) concluded that the status of a memory bias for threat-related information in anxious participants is unclear due to conflicting findings. This conclusion is in contrast to the overall findings for a memory bias for negative information in depression.

Three possible explanations for the conflicting findings in the area of memory bias in anxiety have been postulated. First, it is possible that a memory bias is most prominent with depression (Mineka & Sutton, 1992) and the mixed findings are due to the overlap of depression and anxiety. Second, some negative findings may be due to the content of the stimuli presented in the studies that have

failed to show a memory bias. For example, it is possible that the stimuli used by Nugent and Mineka (1994) did not assess the correct content of threat to detect a memory bias, resulting in the null finding for implicit memory.

Finally, Mathews and Mackintosh (1998) recently suggested that the inconsistent findings in the memory bias research may be due to the way in which the threatening information is encoded. Specifically, they proposed that with anxiety, the primary cognitive activities are non-conscious and exaggerated forms of evolutionary mechanisms. Therefore, this basic system which functions to simply evaluate threat would be unlikely to result in an encoding of threat information in the form of semantic memory. Rather, it is more likely that threat information would be encoded as perceptual representations. Due to this possible encoding method, most memory tests may have been insensitive to the detection of a memory bias associated with anxiety. To date, this specific controversy has not been addressed in the literature.

In summary, the literature pertaining to a memory bias in anxiety has produced a set of findings that are inconsistent. This inconsistency may be due to the ways in which the study of a memory bias in anxiety is conducted. However, the majority of the empirical evidence supports

the conclusion of a memory bias for threat-related information associated with anxiety.

Judgmental Bias The judgmental biases associated with anxiety have received less attention than attentional and memory biases. As a result, the available literature is limited, but it is relevant to the current study. Judgmental biases can be defined as any selective processing of emotional information (Mineka & Sutton, 1992) that results in systematically biased inferences.

Butler and Mathews (1983) presented one of the first articles in the area of judgmental biases in emotional disorders. Anxious, depressed, and control participants were presented a variety of ambiguous situations. The participants then responded to the brief situations with their perceived most likely outcome, one of which was judged to be threat-related during the pilot phase of the study. Both anxious and depressed groups were found to overestimate the risk of future negative outcomes in comparison to the control group. No difference between the two clinical groups was shown in their judgment of future events. The results were interpreted as supporting the association between anxiety and depression with the availability of threat-related information.

Anderson, Spielman, and Bargh (1992) extended the research of Butler and Mathews (1983) to include not only

inferences of ambiguous situations but also judgments of future events. Control and depressed participants were asked to predict both positive and negative events in a reaction time task in which subjects were timed in their responses. It was hypothesized that the highly depressed participants would predict more negative events and show faster reaction times in their predictions. As expected, the highly depressed participants predicted more negative events, fewer positive events, and showed greater automaticity (faster reaction times) in their predictions, in comparison to the control and low depression groups. The results, although not directly applicable to anxiety states, provide support for the proposition that emotional states are associated with negatively biased judgments of future events.

MacLeod and Byrne (1996) also investigated the prediction of future events in depressed and anxious participants. Groups of anxious, anxious-depressed, and control participants were asked to generate future positive and negative experiences over three time periods. The time periods for the prediction of future experiences included within the next week, the next year, and the next five to ten years. The number of experiences generated by the participants was recorded as the measure of positive and negative judgments. It was found that the anxious group

anticipated significantly more negative experiences, when compared to the control group. Furthermore, the anxious-depressed group showed both the anticipation of more negative experiences and less positive experiences. The results were interpreted to suggest that anxiety is characterized by increases in negative thinking and that depression is characterized by both increased negative and decreased positive thinking.

Harvey, Richards, Dziadosz, and Swindell (1993) studied the misinterpretation of ambiguous stimuli in three groups including panic disorder, social phobia, and control participants. Internal and external situations were presented and the participants made judgments as to their explanation of cause. Relative to the control group, both anxious groups interpreted more internal and external situations as threatening. In addition, the panic disorder participants were found to choose a threat-related explanation for interoceptive (internal) stimuli more often than the social phobics. Activation of threat-related memory schemas was offered by the authors to explain the judgment bias. This conceptualization supports the notion that activation of threat-related memory is related to pessimistic predictions of future events.

Of the studies in the area of judgmental biases reviewed thus far, it is of note that only Butler and

Mathews (1983) used stimuli that were threat-related. In a study of judgmental errors in anxiety, Bentz and Williamson (1998) used trait anxiety, perceived personal control, and gender as predictor variables for ratings of the probability of future threatening events. Participants were presented a variety of ambiguous situations and asked to predict the probability of specific threatening outcomes. The results indicated an interaction of anxiety and gender upon probability judgments of future threatening events. Specifically, highly anxious female participants were found to respond with the most pessimistic judgments of future events, but not highly anxious males.

Bentz, Williamson, and Smith (1999) tested the content specificity of a judgmental bias associated with different levels of anxiety and dietary restraint. Participants were administered threat-related and overeating-related stimuli and asked to predict several future negative events. The results showed that both trait anxiety and dietary restraint were associated with the prediction of future negative events. In addition, each of the personality traits was found to be associated with the congruent content of the prediction stimuli. Stated simply, anxiety was found to be associated with the prediction of threat while dietary restraint was found to be related to the prediction of overeating. Finally, an interaction of

gender and anxiety was found replicating the results of Bentz and Williamson (1998). These results suggest that a judgmental bias for future negative events may be a function of the specific events that are to be predicted, and not a general bias across different disorders.

In summary, several conclusions can be made from the reviewed literature pertaining to a judgmental bias in anxiety. First, anxiety appears to be associated with threat-related judgmental errors. Second, the judgmental bias in anxiety may be associated with the specific content of the events that are to be judged.

Conceptualization Given these empirical findings pertaining to cognitive biases, it is possible to draw a logical conceptualization of the biases associated with anxiety. Situational anxiety can be produced by adverse life events and stress. Individuals with higher levels of anxiety have been shown to be more likely to attend to, encode, and recall threat-related information. In addition, it has more recently been shown that anxious individuals are also more likely to judge future events as more threatening.

Thus, for anxious individuals threat-related information is more available in memory than non-threat information which may result in the judgment of future events that are similarly threat-related. Therefore, a

lower threshold for the recollection of threatening information, greater availability of this information, and more probable predictions of future threat may be a factor in the development and maintenance of anxiety disorders.

Several cognitive models of psychopathology have used parts of this conceptualization of cognitive biases in the formulation of their models. For example, Lang (1985) and Bower (1981) both proposed network models of emotion in which threat stimuli and information may be encoded into organized systems that are easily accessed and serve to activate fear. Although not specifically addressed by Lang (1985) or Bower (1981), activation of the "fear networks" would then serve to increase the availability of this information leading to threat-related judgments of future events.

More recently, Mathews and Mackintosh (1998) proposed the only cognitive model of anxiety that addresses not only attentional and memory biases, but also a judgmental bias. Specifically, the model proposes a "threat evaluation system" (TES) which serves as a decision making mechanism to evaluate threat. Input from the TES is increased with higher levels of anxiety. The model also recognizes voluntary effort on the part of the individual as a second factor for input into demand on cognitive processes. Therefore, biases arise from the opposing influences of the

TES and voluntary effort to result in systematic processing of emotional information, including the processing that results in judgmental errors.

Finally, Beck and Clark (1997) proposed a schema-based cognitive model as an extension of an earlier information processing theory (Beck, Emery, & Greenberg, 1985). Three stages of processing are proposed to result in the cognitive, affective, and behavioral pattern of anxiety. In stage I, automatic recognition of information occurs and assigns processing priority to threat stimuli. Then, in stage II, activation of primitive schemas aimed at survival occurs and results in constricted processing of threat to give rise to cognitive biases. Finally in stage III, full activation of schemas occurs and a secondary appraisal of the information results in (1) further escalation of anxiety, (2) reappraisal leading to decreased anxiety, or (3) avoidance and escape.

With the exception of the model proposed by Mathews and Mackintosh (1998), none of the cognitive models reviewed have specifically addressed judgmental biases as a factor in the development and maintenance of anxiety. This may be due to the relative recent emergence of this area of cognitive bias research. As will be addressed in the next sections, a judgmental bias fits well into these cognitive models due to the availability of threat related

information for consideration when individuals make probability judgments.

Probability Forecasting

It is important to the present discussion to review some of the processes involved in inferring the outcomes of future events. First, an understanding of how individuals infer future outcomes will aid in the explanation of how the reduction of judgmental errors may occur. Second, in the case of anxiety, the availability of causes or reasons for an event may be related to the estimation of future outcomes and subsequently the reduction of errors in estimation.

As an example of research on probability forecasting, Hoch (1985) asked graduate students to predict future job offers, salary, and date of employment. In addition, participants generated reasons for why the job offers might and might not occur. The predictions of the participants were compared to actual outcomes obtained from the school's job placement center. The results indicated that accuracy of predictions increased when the participants generated reasons for negative outcomes. Further, the generation of reasons for positive outcomes resulted in lower accuracy of predictions in the direction of optimistic estimates of future job offers and salary.

Weinstein (1980) and Wright and Ayton (1992) also investigated the predictions of future events in a sample of students. Both studies again showed a general tendency for optimistic probability forecasting. In addition, it was suggested that forecasting may depend on the desirability of the situation (Wright & Ayton, 1992), but in general, estimation occurs based on the information that is available at the time of the prediction.

There are several conclusions that can be derived from the probability forecasting literature. First, the amount of information available at the time of prediction is central to the accuracy of the forecasting, with positive information often leading to inaccurate predictions in the positive direction. Second, there appears to be a general tendency for participants to predict positive outcomes, a general optimistic forecasting. Finally, the accuracy of forecasting tends to decrease as the situation becomes more personal and there is less information available.

A common factor in the probability forecasting literature reviewed thus far is the investigation of prediction of future events in samples of novice participants. Probability forecasting in samples of expert participants has also been studied. The estimation of the probability of future events in a sample of experts may be different from forecasting by novices.

Wright, Rowe, Bolger, and Gammack (1994) outlined several possible ways in which experts may be superior to novices at forecasting future events. First, experts may be better calibrated in a specific domain, but equally inconsistent with respect to the laws of probability. Second, expertise may be achieved through simple training in the laws of probability, and therefore more consistent with the laws of probability. Third and finally, experts may be equally poor to non-experts in their calibration in a specific domain, but for reasons other than knowledge of the laws of probability they are better at prediction. Stated simply, experts may be better at forecasting in their specific task, they may be more knowledgeable in probability laws, or they may be better at forecasting for some other unidentified reason.

In fact, the quality of judgments made by experts has been shown to be superior to judgments of novices. Murphy and Brown (1985) found that weather forecasters produce superior predictions of rain. In addition, Vertinsky, Kanetkar, Vertinsky, and Wilson (1986) showed that hockey players can provide high quality probability estimates of the results of their future games. However, identification of the precise factors which result in optimal judgment remains to be established in future research. Thus, probability forecasting in experts may be more accurate

than in non-experts. However, the precise factors involved in the accuracy of judgments remains to be investigated.

Cognitive Heuristics

The ways in which individuals make judgments of frequency, chance, and group membership is often explained by the operation of heuristics, or mental shortcuts, that simplify the judgment and decision process. Kahneman and Tversky (1972, 1982) have described a number of heuristics that are commonly used in human judgment. These include the representativeness, availability, and the anchoring and adjustment heuristics. The three heuristics are reviewed given their relevance to the judgmental processes in predicting future events.

The representativeness heuristic refers to a decision making process in which a person makes judgments based on a comparison to a prototypical example of a similar event. For example, when judging the likelihood of an event, a person may compare the situation to a typical event with similar circumstances. This heuristic has been shown to be frequently used in judgments and decisions of everyday life (Tversky & Kahneman, 1982) and in clinical judgments (Garb, 1996).

The availability heuristic refers to a decision making process in which the person makes judgments based on the ease with which they can recall or cognitively construct

relevant instances. For example, the ease with which an individual can recall events will result in a higher probability estimate, when the individual is asked to judge the frequency of a similar events occurrence. Anderson, Lepper, and Ross (1980) identified two variables that mediate availability judgments: (1) imagery of the event and (2) perceived reasons or causes of the event. It is proposed that the first occurs in novel situations for which there are few similar events encoded in memory from experience and the second occurs in other instances of availability judgments.

The anchoring and adjustment heuristic refers to a decision making process in which people make estimates by considering an initial value that they then adjust to yield the final estimate. For example, when asked to judge the distance of an object, a person often will use a known anchor then adjust their judgment accordingly. Anchoring biases have been shown to robustly influence judgments concerning external information (Tversky & Kahneman, 1974), but they may have less of an impact on self-related judgments.

The most recent advancements in the area of heuristics research has focused on the use of these heuristics in various situations. Agnoli and Krantz (1989) suggested a "competing heuristic model" in which the process by which a

heuristic is selected for use is determined by a competition between the heuristics. In addition, it was suggested that some heuristics are "natural," while others are acquired through learning or experience.

Czaczkes and Ganzach (1996) studied the processes by which heuristics compete and become dominant. In a series of several experiments, the anchoring and adjustment heuristic was compared to the representativeness heuristic. It was found that factors of the situation mediated which judgment heuristic was used. Specifically, saliency of a potential anchor increased the reliance on the anchoring and adjustment heuristic. However, compatibility between the predictor and potential outcome increased the reliance on the representativeness heuristic. Overall, these results support the "competing heuristic model" as proposed by Agnoli and Krantz (1989).

Garb (1996) studied the representativeness versus the past-behavior heuristics in clinical judgments. In a series of three experiments, clinicians made diagnostic judgments from case history information. Similar to Czaczkes and Ganzach (1996), factors of the situation were found to determine which heuristic was used when making judgments. The representativeness heuristic was used by the clinicians when making judgments of diagnosis. However, when judgments involved predictions about the

patients' future behavior, it was found that the clinicians used the past-behavior heuristic.

Thus, two conclusions can be derived from the literature review of cognitive heuristics. First, heuristics such as the representativeness, availability, and the anchoring and adjustment heuristics are mental shortcuts for making judgments in a variety of everyday situations. Second, the particular heuristic that is used in a given situation depends on the factors of that situation.

Debiasing

The study of the reduction of judgmental errors has developed across multiple areas of the literature and has, in general, shown mixed results. The debiasing literature covers the areas of risk perception, clinical judgment, and decision making. One common factor in this literature is the study of the reduction of judgment errors that have been identified in the context of cognitive heuristics, or mental shortcuts. An important component of this literature is that the existing studies have not addressed the process of debiasing in the context of emotion, and more specifically anxiety.

A review of the debiasing techniques is addressed for relevant findings given their pertinence to the current study. In addition, the implications for debiasing in the

context of anxiety and its association with the pessimistic judgments of future threat are discussed.

Fischoff (1977) presented one of the first articles on debiasing of judgmental errors. Participants were asked to respond to 75 general questions by assigning a probability of being correct to two possible answers. Results indicated that the participants overestimated how much they would have known before being told the answer, a knew-it-all-along effect. In addition, attempts to debias these judgmental errors, by either informing participants about the bias or asking them to work harder, failed to result in a reduction of the bias.

Friedlander and Phillips (1984) investigated the reduction of anchoring errors in two groups of undergraduate participants. A control group and a group that was warned of anchoring errors were asked to read case studies in which important information concerning clinical diagnosis of disease was presented. The participants completed both diagnostic judgment ratings and confidence ratings. The debiasing method used in the study was an educational technique that informed the participants of the possibility of errors in judgment due to the anchoring and adjustment heuristic. No anchoring effect was found in the control group, eliminating the possibility to evaluate the educational debiasing technique. However, participant

confidence ratings in their judgments were found to be low, resulting in the author's speculation that the low confidence level led to a decreased susceptibility to the anchoring effect. The implication for debiasing was that the experimental procedures may require stimuli in which the participants have confidence in their judgments.

Sharpe and Adair (1993) studied the reduction of the hindsight bias and addressed a rival hypothesis of demand characteristics. The hindsight bias is defined as the increased confidence in judgments after being provided information as to the validity of the statement. In two similar experiments, participants were provided an explanation of the hindsight bias and asked to either produce the bias or not to produce the bias. When participants were asked not to produce the hindsight bias, the hindsight error in judgment was still found. Further, when participants were asked to produce the bias, especially exaggerated judgment ratings were found. The authors concluded that the manipulation of instructions does little to eliminate the hindsight bias. This educational technique for debiasing judgments was similar to the technique use by Friedlander and Phillips (1984) and suggests that simple awareness of the judgment error does not reduce a judgment bias. Furthermore, Sharpe and Adair (1993) concluded that an increase in demand characteristics

can lead to an even more robust hindsight bias, a finding that will be discussed in greater detail in the later section devoted to demand characteristics.

In a study of optimistic biases of perceived health risks, Weinstein and Klien (1995) investigated several debiasing techniques in altering ratings of personal health risks. In a series of four experiments, participants were given four different debiasing interventions that were hypothesized to reduce the optimistic bias. The debiasing interventions included educational, imagery, risk factor focus, and risk factor generation techniques. All debiasing methods were unsuccessful in reducing optimistic risk judgments. Reminding people of health risks and having the participants compare themselves to low-risk people, the educational and imagery debiasing techniques, did not reduce the optimistic bias. Furthermore, the tasks of having participants focus on health problems, the risk factor focus and risk factor generation debiasing techniques, actually resulted in an exaggerated bias.

Mumma and Wilson (1995) investigated the debiasing of anchoring effects in clinical judgments of personality characteristics. Participants were presented a description of an individual's personality characteristics and then they were asked to make stable/unstable and introversion/extroversion judgments of that individual.

Three types of debiasing techniques were used which included bias inoculation, consider-the-opposite, and note taking methods. The bias inoculation technique was an educational method of debiasing in which the participants were instructed in the use of an adjustment to compensate for the initial anchor. The consider-the-opposite method had participants focus on opposite personality characteristics to the cues presented in the description. Finally, the note taking method had participants write down the cues of the personality characteristics presented in the description. The results indicated that all three methods of debiasing resulted in a reduction of the anchoring bias. In addition, the two methods that forced participants to focus on the critical information presented in the description, the consider-the-opposite and note taking methods, showed a significantly greater reduction in the anchoring effect in comparison to the educational method, bias inoculation. Mumma and Wilson (1995) suggested that these two techniques functioned to increase the accessibility of alternative information to reduce the anchoring effect.

Hirt and Markman (1995) studied the process with which debiasing occurs for another judgmental bias called the explanation bias. The explanation bias is an increase in judgments of subjective probability that occurs after

participants are provided with an explanation of why the outcome would occur. In the Hirt and Markman (1995) study, participants were presented a variety of explanations of situations, for example a winning sports team, and the outcome of the likelihood of upcoming games was judged. Several variations on the Consider-An-Alternative debiasing technique were used and included generation of multiple outcomes, generation of the opposite outcome, and generation of highly unlikely outcomes. Overall findings indicated that techniques that involved the generation of alternative outcomes resulted in a reduction of the explanation bias. Hirt and Markman (1995) concluded that the increased accessibility of alternative information resulted in the reduction of the explanation bias.

In a study of anchoring effects, Whyte and Sebenius (1997) investigated the presentation of single versus multiple anchors in the reduction of the anchoring effect for both individuals and groups. Participants were given information regarding a fictitious product and they were asked to negotiate the sale of the product. The results indicated that participants in a group setting were as susceptible to the anchoring bias as were individuals. In addition, providing the participants with multiple anchors, and thus increasing the amount of information, did not reduce the bias.

In another study of group judgment, Lim and Benbasat (1997) investigated the debiasing of the representativeness heuristic. Participants in groups of three were presented personality profiles of engineers and lawyers as a modified base-rate problem originally used by Tversky and Kahneman (1974). In addition, half of the participants were able to use a computer generated "problem-representation" tool that graphically displayed a map of the lawyers and engineers. Use of the computer generated support system led to greater awareness of the base-rate fallacy and a reduction in the representativeness error. Lim and Benbasat (1997) attributed the debiasing result to the increased awareness of base-rates and the increased amount of information available from the computer generated support system.

Overall, the studies on the debiasing of judgment errors that have been presented thus far are laboratory investigations of the cognitive heuristics and various techniques to reduce errors in judgment. However, there is another area of the literature that examines debiasing in a different manner, namely, the study of the reduction of biases in judgment that result from personal experience.

Dolinski, Gromski, and Zawisza (1989) collected data from participants in Opole, Poland approximately one week after the 1986 explosion of the Chernobyl atomic power station in the Ukraine. Participants rated their perceived

risk and the perceived risk of others for a variety of negative events including contracting diseases, being involved in accidents, and being the victim of crime. In comparison to the ratings of others, the participants indicated an unrealistic optimism for their own likelihood of experiencing future crime, accidents, and for suffering from heart disease. However, for negative events related to radiation exposure, the participants rated themselves as especially susceptible in comparison to others. The results suggest that the personal experience of the Chernobyl disaster reduced the optimistic bias of perceived risk for radiation-related negative events.

Burger and Palmer (1992) asked university students who had experienced the northern California earthquake of 1989 to estimate the probability that they and other "average" students would experience several negative life events. The negative life events used in the study included health, crime, accident, and natural disaster related outcomes. The results indicated an unrealistic optimism for the negative life events related to health, crime, and accidents. However, this optimism for the life event related to natural disasters was not found immediately after the earthquake. The optimism for natural disasters returned three months later. The results suggest that

personal experience may lead to a reduction of the optimistic bias, but only in the short term.

Rutter, Quine, and Albery (1998) studied the perceptions of risk in motorcyclists. Participants completed several questionnaires, rated the likelihood of accidents and injury for themselves and others, and reported their history of risky motorcycle riding. Results showed that motorcyclists were unrealistically optimistic about their chances of being in an accident. Decreased perceptions of risk were associated with higher age, higher educational levels, and higher levels of riding experience. However, when participants who reported having experienced an accident in the past were compared with those who had no experience of an accident, a significant difference in the perceptions of risk was found. Specifically, experience with a past accident was associated with a "relative realism" of perception of risk, a reduced optimistic bias for the likelihood of future accidents.

Finally, Stapel and Veltuijsen (1996) conducted two studies to test the hypothesis that indirect experience can reduce perceptions of risk. Undergraduate participants were presented newspaper articles with varying levels of vividness of the story and self-relevance to the participants. The participants then made personal and societal risk judgments. The results showed that indirect

experience of highly vivid and self-relevant information was associated with a reduction of perceived risk. These findings concerning indirect experience are consistent with the results of direct experience upon perceived risk (Burger & Palmer, 1992; Dolinski, Gromski, & Zawisza, 1989; Rutter, Quine, & Albery, 1998).

In summary, the current state of the debiasing literature suggests several conclusions. First, educational debiasing strategies appear to do little for the reduction of the targeted biases. Second, techniques that force the participant to focus on the stimuli that were presented also do not appear to reduce the bias, and may in fact even create a more robust judgmental bias. Third, techniques that force the participant to focus on alternative information or alternative outcomes appear to significantly reduce the targeted bias. And finally, personal experience with negative events appears to reduce the optimistic bias for that specific event.

A review of the debiasing literature was presented by Arkes (1991). Arkes introduced three separate categories of judgment errors which included strategy-based errors, association-based errors, psychophysically-based errors. In addition, several techniques to reduce the biases were proposed. Specifically, for strategy-based errors, it was proposed that debiasing should occur when the benefits of

accurate judgment are increased. For association-based errors, debiasing should occur with the performance of a behavior that activates different associations within the semantic memory. Finally, for psychophysically-based errors, debiasing should occur with a change in the person's perception of their location on the nonlinear curve depicting the relationship between the external stimuli and the response to the stimuli.

The reduction of judgmental errors for the current study primarily focuses on Arkes' (1991) association-based errors and the results of these judgmental bias studies follows Arkes' proposal of effective debiasing. Specifically, the studies that show a reduction in judgmental errors use techniques that serve to activate alternative associations within semantic memory (Hirt & Markman, 1995; Lim & Benbasat, 1997; Mumma & Wilson, 1995).

However, it is important to note that the available literature pertaining to debiasing focuses on simple strategies to reduce common judgmental errors in normal populations. The current study proposes to investigate the reduction of pessimistic judgmental errors associated with anxiety. In the next section, cognitive-behavior therapy and its role in debiasing will be addressed.

Role of Debiasing in Cognitive-Behavior Therapy

Possibly the most significant implication of this study is the role that debiasing may play in cognitive-behavior therapy. The importance of the reduction of pessimistic thoughts of future events has been noted in established cognitive-behavioral treatment programs. However, the recognition of this potential benefit for the treatment of anxiety disorders has not been addressed in the current cognitive models of the development and maintenance of anxiety. Each of these specific points will be discussed briefly to emphasize the role that debiasing may play in cognitive-behavioral treatment of anxiety disorders.

The reduction of pessimistic predictions of future events has been recognized as therapeutic in a few established treatment programs (Craske, Barlow, & O'Leary, 1992; Barlow & Craske, 1994). Specifically, Craske et al. (1992) included in their treatment manual for Generalized Anxiety Disorder a section devoted to the overestimation of risk. The treatment program offers several techniques to reduce the patient's perception of risk including monitoring exercises and generation of realistic probabilities of event occurrence. However, it is important to note that the Mastery of Your Anxiety and Worry (MAW) program does not offer the specific treatment

technique of the generation of alternative outcomes and only mentions the ultimate goal of considering alternatives.

Barlow and Craske's (1994) Mastery of Your Anxiety and Panic II (MAP-II) treatment program for Panic Disorder also recognized the importance of the reduction of pessimistic predictions of future events. In this treatment program, monitoring exercises were used as a therapeutic technique to reduce judgmental errors. In addition, direct behavioral testing of predicted threat events combined with the monitoring was also recommended. However, similar to Craske et al. (1992), Barlow and Craske (1994) did not offer the generation of alternative outcomes as a specific therapeutic technique to reduce the judgmental errors.

The two treatment programs briefly reviewed above have been shown to be effective in the treatment of anxiety disorders (Craske et al., 1992; Barlow & Craske, 1994). Unfortunately, the specific components of the programs have not been empirically studied to investigate the parts of the programs that are successful in the reduction of anxiety symptoms. The techniques for the reduction of the overestimation of risk offered by Craske et al. (1992) and Barlow and Craske (1994) do not appear to follow the empirical findings in the debiasing literature. Specifically, the techniques offered do not apply a

generation of alternatives approach to the reduction of pessimistic predictions of future threatening events. However, this may be explained by the fact that previous cognitive models of the development and maintenance of anxiety have failed to address judgmental biases.

As presented earlier, current cognitive models of anxiety have emphasized attentional, memory, and judgmental biases in the development and maintenance of anxiety. It remains to be seen what results will be found when specific techniques for the reduction of cognitive biases are applied to the treatment of anxiety disorders. However, the potential benefit of the alleviation of anxiety symptoms and behaviors is one possible result of debiasing.

A small body of research exists that has investigated the cognitive changes that result from treatment. In general, these studies have used various measures of attentional, memory, and judgmental biases before and after a patient's participation in a treatment program. It is hypothesized that some component of the psychotherapy will result in a reduction of the cognitive biases being measured. However, the current stage of the research has not investigated specific debiasing techniques, nor if the reduction in the cognitive biases results in an alleviation of anxiety symptoms and behaviors.

Mathews, Mogg, Kentish, and Eysenck (1995) had participants complete both a Stroop color-naming task and a word completion task before treatment, after treatment, and at a three-month follow-up. An anxious group, consisting of participants with a diagnosis of generalized anxiety disorder (GAD), was given an anxiety management procedure that included relaxation training, cognitive coping strategies, and graded exposure. The treatment resulted in a reduction of the cognitive biases.

Mogg, Bradley, Millar, and White (1995) presented a control group and a group of generalized anxiety patients (GAD) with a Stroop color-naming task at pre-treatment, post-treatment, and follow-up. The treatment consisted of cognitive and behavioral procedures including relaxation and cognitive coping techniques. Initially, the GAD group showed the expected attentional bias for threat-related information in comparison to the control group. At post-treatment, no attentional bias was found. However, at follow-up the attentional bias was again significant. The results suggest that the cognitive-behavioral treatment was successful at normalizing the attentional bias. However, the attentional bias may not be a stable phenomena in that it varies over time.

Westling and Ost (1995) had patients respond to body related and external situations before treatment, after

treatment, and at a follow-up. The patients were randomly assigned to either an applied relaxation (AR) treatment or cognitive-behavior therapy (CBT). At pre-treatment, a judgmental bias was found that was specific to body related stimuli, in comparison to the control group. No threat-related judgmental bias for external stimuli was found. At post-treatment, both AR and CBT were found to lead to a normalization of the threat bias and there was no superiority of either treatment method. The results suggest that cognitive changes that occur with psychological treatment include a normalization of threat-related judgmental errors.

Thus, cognitive and/or behavioral treatment techniques appear to normalize the attentional, memory, and judgmental biases associated with anxiety. Which specific component or cognitive process of the treatment procedures that result in this normalization is unclear at this time. However, the potential benefit of a reduction in judgmental cognitive biases is considerable for the treatment of anxiety.

It is important to note that the normalization of biases in anxiety has been shown after many sessions of cognitive-behavior therapy. The current dissertation proposes a technique to reduce pessimistic predictions of future events associated with high levels of anxiety

responsiveness with a simple strategy in a short period of time. However, the study can be viewed as the investigation of one of the specific components of CBT and its ability to reduce one specific type of cognitive bias, namely judgmental errors.

Demand Characteristics

Demand characteristics are defined as experimental cues which influence participants to respond in specific ways that serve to validate the experimental hypothesis (Fernandez & Turk, 1994). The importance of demand characteristics in psychological experiments was highlighted over 30 years ago in a series of studies and writings by Orne (1962, 1970, 1973).

Orne made several assumptions of demand characteristics that have become a widely shared consensus among researchers without adequate evidence. First, Orne (1970) assumed that experimental participants have a desire to help science, presumably because the success of the study will make their service worthwhile. Second, Orne (1962) assumed that experimental participants seek to ascertain the purpose of the study. Finally, it is assumed that participants are eager to confirm the hypothesis or purpose of the study (Orne, 1973).

However, the assumptions of demand characteristics as outlined by Orne (1962, 1970, 1973) have not been supported

in the literature. In a review of the literature, Berkowitz and Troccoli (1986) concluded that there is little support for Orne's assumptions.

In a study that examined the tendency of participants to confirm a hypothesis from the experimental cues, Buchwald, Strack, and Coyne (1981) investigated a mood induction procedure and assessed the participants' belief that their level of affect would be influenced. The results showed that although a clear mood induction occurred, the participants believed that their feelings could not be influenced by reading and thinking about the statements given in the induction procedure. Stated simply, although experimental cues for mood induction were present, i.e. demand characteristics, the participants did not show a conscious willingness or desire to confirm the hypothesis.

The findings presented thus far suggest that the assumptions of demand characteristics as presented by Orne (1962, 1970, 1973) may be flawed. However, these findings are not suggestive that an alteration of responses due to experimental cues does not occur. As proposed by Berkowitz and Troccoli (1986), it is possible that the role of demand characteristics is exaggerated. However, it remains a possibility that experimental cues alter responses of experimental participants in measurable ways.

For example, Alloy, Abramson, and Viscusi (1981) and Polivy and Doyle (1980) also studied a mood induction procedure and asked participants to simulate the affective reaction. In both studies, a pattern of "over-reaction" was noted where the participants gave more extreme responses than the actual mood induction. The mood induction itself was unresponsive to demand characteristics. These results suggest that experimental demand may lead to an exaggerated result, while showing little ability to reduce the mood induction.

In the only study that has specifically addressed demand characteristics in the debiasing of judgments, Sharpe and Adair (1993) investigated the reduction of the hindsight bias while manipulating instructions. Participants were informed of the errors in judgment associated with the hindsight bias. They were asked either to produce or to not produce the bias by manipulation of instructions. In the group that was asked to not produce the hindsight bias, the low demand condition, the bias was unaffected by the instruction. However, in the group that was asked to produce the hindsight bias, the high demand condition, biased judgments were found to be even more elevated indicating a more robust hindsight bias. The authors concluded that manipulation of instructions does little to reduce the judgmental errors associated with the

hindsight bias. Furthermore, an increase in demand characteristics appeared to lead to an even more robust hindsight bias. It is important to emphasize that manipulation of demand characteristics did not result in a reduction of the hindsight bias, but an exaggeration of the bias. This finding supports the results of Alloy, Abramson, and Viscusi (1981) and Polivy and Doyle (1980).

Thus, demand characteristics remain a rival hypothesis for the debiasing of judgmental errors. Although the assumptions of demand characteristics may be flawed, as outlined by Orne (1962, 1970, 1973), the specific study of the relationship between experimental demand and the debiasing of judgmental errors in anxiety remains to be accomplished.

It is important to note for the purpose of the current study the two main methods used in the investigation of demand characteristics. First, experimental demand is often manipulated by the presentation of different instructions creating groups of high and low demand characteristics (Alloy, Abramson, & Viscusi, 1981; Polivy & Doyle, 1980; Sharpe & Adair, 1993). Second, several studies have used a procedure that includes a debriefing strategy in which participants are explicitly questioned after the experiment to probe for the possibility that they were responding to the experimental cues of the study

(Schaller, Asp, Rosell, & Heim, 1996). It is this debriefing strategy and the inclusion of a second set of prediction stimuli that will be used in the current study to probe for the demand present within the experimental treatment.

Conclusion

From this review of the research literature, it was possible to construct a formulation of the theoretical concepts for this study. Situational anxiety can be produced by adverse life events and stressors. Individuals with higher levels of anxiety responsiveness have been shown to be more likely to attend to, encode, and recall threat-related information. In addition, it has more recently been shown that anxious individuals are also likely to judge future events as more threatening.

Thus, anxious individuals have threat-related information that is more available than non-threat information, which may result in the judgment of future events that are similarly threat-related. Therefore, the combination of easily recalled threatening information, availability of this information, and predictions of future threat may be a factor in the development and maintenance of anxiety disorders.

The debiasing of judgmental errors has been suggested to occur when the activation of alternative associations

within memory occurs. According to the probability forecasting literature, the information that is available at the time of prediction is directly related to the accuracy of the prediction. In the case of higher levels of anxiety, the information that is available is likely to be threat-related, leading to pessimistic predictions of future threat.

However, if an individual with higher levels of anxiety can learn to or, in the case of the current study, be instructed to consider alternative information, the available information at the time of prediction is less likely to be threat-related. This availability of more neutral or even positive information may lead to predictions of future events that are less threat-related.

This process of availability of information leading to predictions may be different for males and females. As reported earlier, Bentz and Williamson (1998) and Bentz et al. (1999) found an interaction of anxiety and gender upon future threat probability judgments such that highly anxious female participants responded with the most pessimistic judgments of future events. Previous studies (Nolen-Hoeksema, 1991) have hypothesized that gender differences in ruminative thinking may account for differences in the prevalence of depression. Therefore, one possible explanation of this interaction between gender

and anxiety is that women may perceive the environment as more threatening, resulting in the interaction of gender and actual life events that produces anxiety to yield more pessimistic probability ratings in highly anxious females.

The study of a judgmental bias associated with anxiety and the availability mechanism that theoretically results in judgment errors can be criticized due to a methodological problem. Specifically, the obvious nature of the experimental tasks used in previous studies (Bentz & Williamson, 1998; Bentz et al., 1999) leads to a demand characteristic rival interpretation of the findings. Stated simply, the judgmental biases may have been due to the participants perception of the experimental cues inherent within the procedures.

Thus, it was the goal of the current study to investigate one debiasing technique, the Consider-An-Alternative procedure (Hirt & Markman, 1995) and its ability to reduce judgmental errors. In addition, the rival hypothesis of demand characteristics was examined as a possible explanation of any findings of the reduction of judgmental errors.

Pilot Study

A pilot study was conducted in order to test two essential methodological questions that are central to the completion of the dissertation. First, it was methodologically essential for the dependent variable to be demonstrated as a sensitive measure of the reduction in probability ratings that was expected with the debiasing procedure. Without such a measure, it was possible that the study would be unable to detect the reduction in the prediction bias ultimately resulting in a null finding due to a type II error.

Second, in a study that investigates the role of demand characteristics it was methodologically essential to demonstrate that the experimental cues inherent within the stimuli themselves were not causing a response bias. If the experimental cues inherent within the stimuli were found to cause a systematic response bias, the response bias would confound any results that were found to be due to an experimental manipulation. Given the obvious nature of the experimental task in the current study, reading situations and judging outcomes, addressing the experimental demand inherent within the stimuli themselves averts this possible methodological criticism.

Therefore, a pilot study was conducted with two separate experiments, each of which was designed to address

one of the methodological questions. Phase 1 of the pilot study was designed to address the question of the sensitivity of the dependent variable. Phase 2 addressed the demand characteristics inherent within the experimental stimuli.

Phase 1

Design/Rationale Phase 1 of the pilot study was designed to test the sensitivity of the dependent variable, probability ratings of future threat-related events. Phase 1 was designed to demonstrate that the participant's probability ratings would be a sensitive measure of the changes in perceived threat that was expected with the debiasing procedure. Specifically, it was hypothesized that the participant's probability ratings would decrease due to the Consider-An-Alternative (Hirt & Markman, 1995) debiasing procedure, when probability ratings are compared from pre to post testing.

An experimental design that was similar to the dissertation study was chosen for two reasons. First, the design and procedures for Phase 1 of the pilot study were identical to those proposed for the dissertation, and therefore will mimic any results due to debiasing. Second, a design for Phase 1 that included the debiasing procedure was chosen because this technique was essential to the demonstration of a sensitive dependent variable.

Specifically, a repeated measures design was chosen in which the participants complete the identical experimental stimuli twice, separated by the Consider-An-Alternative debiasing procedure, in a pre-post design. The experimental stimuli used in Phase 1 of the pilot study were the identical positive and negative stimuli (Appendix A and Appendix B) that were used in the dissertation. The debiasing procedure was used in Phase 1 because this technique was expected to show a decrease in probability ratings for the dissertation. Therefore, the debiasing procedure offers the most likely chance of demonstrating the sensitivity of the dependent variable.

In addition, in order to further increase the likelihood that the sensitivity of the dependent variable would be demonstrated, only participants with a high level of anxiety responsiveness were included in Phase 1. A criterion for inclusion in Phase 1 of the pilot study was set at a trait anxiety T-score of 60 or above on the State Trait Anxiety Inventory (STAI: Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E., 1970). The criterion for participation was chosen because it provided a group of participants that were most important for the dependent variable to be able to measure changes in probability estimates. Stated simply, if no change in probability estimates was detected for a group of highly anxious

participants, then it would be even less likely that the dependent variable would be a sensitive measure for participants with lower levels of anxiety responsiveness.

Participants A total of 49 students were screened for participation in Phase 1 of the study. Twelve students met the criteria of a trait anxiety T-score of 60 or above (3 male and 9 female). The sample included a racial make up of five Caucasian (41.7%), five Hispanic (41.7%), and two African-American (16.7%) participants. The average age of the sample was 19.5 years (*SD* = 1.8 years). Finally, the mean trait anxiety for the participants was a T-score of 65.5 (*SD* = 6.7).

Results Two repeated measures ANOVAs were conducted, one each for the positive and negative experimental stimuli. The repeated measures variable utilized in the analyses were the pre and post-testing probability ratings.

For the negative experimental stimuli, a significant main effect for the within subject repeated measure was found ($F[1,11] = 4.94$, $p < .05$). Average probability ratings for the negative pre-testing (mean = 59.9%, *SD* = 11.65) and the negative post-testing (mean = 53.1%, *SD* = 14.39) showed a decrease in future threat estimates as hypothesized. For the positive experimental stimuli, the repeated measure was found to be nonsignificant ($F[1,11] = 2.94$, p = NS).

Discussion Phase 1 of the pilot study was designed to test the sensitivity of the dependent variable by demonstrating that the participant's probability ratings would be a sensitive measure of the changes in perceived threat that were expected with the debiasing procedure. The analysis showed that there was a significant difference in threat probability ratings from pre to post-testing, when separated by the Consider-An-Alternative debiasing procedure. This finding suggests that the dependent variable, probability ratings, is a sensitive measure of the changes in likelihood estimates that were expected in the dissertation. Therefore, it can be concluded that the dependent variable can be relied upon as a sensitive measure for the dissertation.

Phase 2

Design/Rationale Phase 2 of the pilot study was designed to demonstrate that the demand characteristics inherent within the experimental stimuli (Appendix A and Appendix B) were not causing a systematic response bias. Specifically, it was hypothesized that participants who complete only the negative experimental stimuli would show no difference in probability ratings in comparison to participants who completed both the positive and negative stimuli. In addition, it was hypothesized that the same

pattern of results would be found with the positive experimental stimuli.

Again, Phase 2 of the pilot study included a design that was similar to the dissertation study to create groups that were as analogous to the dissertation groups as possible. Three groups of participants were administered the experimental stimuli in a pre-post repeated measures design. The experimental stimuli utilized in Phase 2 were identical to the stimuli that were used in the dissertation. Group 1 completed both the positive and negative experimental stimuli. Group 2 completed only the negative stimuli. Finally, Group 3 completed only the positive experimental stimuli.

If the demand characteristics inherent within the experimental stimuli were causing a systematic response bias, then the participants who received only the negative stimuli (Group 2) would respond with more extreme probability ratings in comparison to the participants who received both the positive and negative stimuli (Group 1). In addition, the opposite pattern of responses would be expected when comparing Group 3 and Group 1, if the demand characteristics inherent within the stimuli were causing a response bias. However, this pattern of response was not expected due to the deliberate construction of the

experimental stimuli to disguise its purpose with positive items, negative items, and reverse scored items.

Participants A total of 57 participants comprised the sample of Phase 2 of the pilot study (24 male and 33 female). The sample was primarily Caucasian (*n* = 35, 61.4%), with 11 Hispanic (19.3%), seven African-American (12.3%), and four participants identified as other ethnic origin (7.0%). The average age of the participants was 22.09 years (*SD* = 6.4 years). Finally, the mean trait anxiety T-score for the sample was 50.7 (*SD* = 8.9).

Results Two repeated measures 2 X 2 ANCOVAs (Group X Repeated Measure) were conducted, one each for the positive and negative experimental stimuli. Stated simply, Group 1 was compared to Group 2 in the repeated measure ratings of future threat-related events and Group 1 was compared to Group 3 in the repeated measure ratings of future positive events. The repeated measures variable utilized in the analyses were the average pre and post-testing probability ratings. Trait anxiety was used as the covariate to statistically control for the variance due to anxiety responsiveness.

For the negative experimental stimuli, no significant main effects for group ($F[1,35] = 0.08$, p = NS) or the repeated measure ($F[1,35] = 0.50$, p = NS) were found. In addition, the interaction between group and the repeated

measure was found to be nonsignificant ($F[1,35] = 0.83$, p = NS). Trait anxiety was found to be a significant covariate ($t[34] = 2.30$, $p < .05$).

A similar pattern of results was found for the positive experimental stimuli. No significant main effects were found for group ($F[1,36] = 0.67$, p = NS) or the repeated measure ($F[1,36] = 2.97$, p = NS). Again, the interaction between the independent variables was found to be nonsignificant ($F[1,36] = 0.93$, p = NS). Finally, trait anxiety was again found to be a significant covariate ($t[35] = 3.59$, $p < .005$).

Discussion Phase 2 of the pilot study was designed to demonstrate that the demand characteristics inherent within the experimental stimuli were not causing a systematic response bias. As hypothesized, no significant differences were found between the group that completed both the positive and negative stimuli in comparison to the two groups that completed just one set of the experimental stimuli. In addition, trait anxiety was found to be significantly correlated to probability ratings of both the positive and negative stimuli.

These results suggest that the demand characteristics inherent within the experimental stimuli would not cause a systematic pattern of response that would confound any results of the dissertation. Therefore, it can be assumed

that any main effects found for the high or low demand groups in the dissertation may be due to the experimental manipulation and not to a confound of the experimental cues inherent within the stimuli.

Methods

Participants

Initially, a sample of 476 (197 male and 279 female) undergraduate students participated in the study. The participants were screened for inclusion using the Trait form of the State-Trait Anxiety Inventory (STAI: Spielberger et al., 1970) as the measure of anxiety responsiveness. All participants were volunteers recruited through undergraduate psychology classes and sign-up sheets posted in the psychology department of Texas Wesleyan University in Fort Worth, Texas. Extra credit was given to all students who participated in the study. The initial sample was primarily Caucasian (*n* = 330, 69.3%), with the remainder of the participants reporting an ethnic make-up consisting of 70 (14.7%) African American, 43 (9.0%) Hispanic, and 33 (6.9%) participants identified as other ethnic origin. The average age for the sample of undergraduate students was 23.13 years (*SD* = 6.17 years, Range = 17 to 55 years). Finally, the mean STAI trait anxiety T-score for the sample was found to be 51.90 (*SD* = 10.02).

A criterion for inclusion in the highly anxious group was set at a T-score of 65 or greater on the trait form of the STAI. Data collection was continued until a minimum of 15 male and 15 female participants were found for both the

debiasing and control groups that met the STAI T-score criteria for inclusion in the highly anxious group. Thus, the highly anxious group consisted of a minimum of 60 participants, 15 males for both the debiasing and control groups and 15 females for the same two treatment groups.

Participants who were included in the "normal" anxiety group were randomly selected from the remaining students assessed with the STAI. A trait anxiety criterion for inclusion in the "normal" group was set at a T-score of 60 or less on the STAI. In addition, the participants included within the "normal" group were matched to the highly anxious participants on several variables including treatment group, age, gender, and race. Accordingly, a minimum number of 60 participants, 15 males for both the debiasing and control groups and 15 females for the same two treatment groups, within the "normal" anxiety group were identified for inclusion. Therefore, the total sample for the experiment was, at a minimum, set at 120 participants.

For both the highly anxious and "normal" groups, a total of 132 undergraduate students were found who met criteria for inclusion in the study. The racial composition of the sample was primarily Caucasian (n = 106, 80.3%), with the remaining participants identified as African American (n = 16, 12.1%), Hispanic (n = 6, 4.5%),

and other ethnic origin (n = 4, 3.0%). The average age of the study participants was 22.07 years (SD = 4.08 years, Range = 18 to 43 years). Finally, the average STAI trait anxiety T-score for the participants within the highly anxious group was found to be 69.41 (SD = 4.70, Range = 65 to 82). For the "normal" group, the average STAI trait anxiety T-score was 49.77 (SD = 6.01, Range = 35 to 60).

With one notable exception, the demographic data for the highly anxious and "normal" groups were equal due to the matching of study participants. Divided in terms of gender and treatment group, the number of highly anxious male participants in the control group and the debiasing group was 15, while highly anxious female participants within the control group numbered 20 and within the debiasing group numbered 16. However, one male African American (Age = 32 years) participant in the highly anxious group was matched to another participant in the "normal" group with one year difference in age (Age = 33 years). This match was performed because no exact match was found. Finally, three participants identified as highly anxious were excluded from the study because no close match could be found due to difficult age and race matching.

Assessment Measures

Spielberger State-Trait Anxiety Inventory (STAI)

The STAI (STAI: Spielberger et al., 1970) is a paper and pencil

inventory designed to measure both state and trait anxiety. The trait form was used for the measurement of the level of anxiety responsiveness in all participants and was used to group the subjects into a highly anxious and a "normal" group. The criteria for inclusion in the highly anxious group was any participant that scored at or above a STAI T-score of 65. The criteria for inclusion in the "normal" group was any participant that scored at or below a STAI T-score of 60. Evidence for the reliability and validity of the State-Trait Anxiety Inventory has been reported in previous studies (Martuza & Kallstrom, 1974).

Experimental Stimuli A total of twenty experimental stimuli were constructed, ten of which present negative (threat-related) situations, and ten of which present positive situations with content matched to the negative. The stimuli were constructed, with minor modifications, from the threat-related prediction paragraphs validated by Bentz and Williamson (1998). Validation of the prediction paragraphs included participant ratings which demonstrated that the stimuli were perceived as threatening. Specifically, the study (Bentz & Williamson, 1998) established that the threat-related experimental stimuli used in the present investigation were perceived as significantly more threatening than a second set of stimuli. In addition, Bentz and Williamson (1998)

demonstrated the validity of the deliminated number line rating, used in the current investigation, in comparison to two other rating procedures which included a non-deliminated number line and a Likert scale. The experimental stimuli, judgment ratings, and questions are presented in the Appendix A and Appendix B. The randomized stimuli are separated into the pre-testing (Appendix A) and the post-testing (Appendix B) experimental stimuli. The order of presentation of the stimuli to the study participants is illustrated in Figure 1.

Half of the prediction questions for the pre and post-testing stimuli were reverse scored in order to disguise the measurement of pessimistic predictions. An equal number of reverse scored questions were presented in each of the pre and post-testing. Thus, the pre-testing consists of a total of twenty experimental stimuli, ten each of positive and negative (threat-related) stimuli. Furthermore, each of the ten positive and ten negative stimuli presented in the pre-testing had five prediction questions that were reverse scored. The twenty pre-testing experimental stimuli, thus, resulted in five negative situations with negative questions, five negative situations with positive questions, five positive situations with negative questions, and finally five positive situations with positive questions. In the

Group	Pre-Testing	Treatment	Post-Testing	Debrief
Control	A, E	D	B, F	G
Debiasing	A, E	C	B, F	G

A - Pre-Testing Experimental Stimuli (Appendix A)
B - Post-Testing Experimental Stimuli (Appendix B)
C - Consider-An-Alternative Debiasing Stimuli (Appendix C)
D - Control Stimuli (Appendix D)
E - Pre-Testing Experimental Demand Stimuli (Appendix E)
F - Post-Testing Experimental Demand Stimuli (Appendix F)
G - Debriefing Questions (Appendix G)

Figure 1

Diagram of the study experimental design and order of presentation of the stimuli in each phase of the study.

post-testing, the same twenty paragraphs were presented with the opposite prediction questions to the pre-testing stimuli.

Only the ratings from the negative (threat) stimuli were utilized in the statistical analysis for three reasons. First, this study was mainly interested in the reduction of pessimistic predictions of future negative events that may result from debiasing, not the reduction of optimistic predictions. Second, the inclusion of the ratings from the positive stimuli in the statistical analysis would raise the complexity of findings to a level that would make interpretation difficult. Finally, changes in the ratings of the positive stimuli were, theoretically, less important than the negative (threat) stimuli because the debiasing procedure includes only the generation of positive outcomes.

The purpose of the inclusion of the positive stimuli within the pre and post-testing was to disguise the objective of the stimuli as much as possible in order to minimize the demand characteristics inherent within the stimuli themselves. The methodological question of whether the demand characteristics inherent within the experimental stimuli were causing a systematic response bias was addressed in Phase 2 of the pilot study.

Consider-An-Alternative Debiasing Stimuli The Consider-An-Alternative debiasing procedure was constructed to model the procedures used by Hirt and Markman (1995) and to achieve the goal of increasing the salience and accessibility of alternative outcomes of the experimental situations. Specifically, the twenty experimental stimuli identical to the ten positive and ten negative pre and post-testing stimuli were presented. Participants were then asked to generate three positive alternative outcomes, which forced the activation of alternative information.

The generation of alternatives was only completed by the debiasing group and not the control group. The debiasing stimuli are presented in Appendix C and the order of presentation of the stimuli to the study participants is illustrated in Figure 1. It is important to note that none of the experimental demand stimuli (Appendix E and Appendix F), described below, were presented within the debiasing condition.

Control Stimuli The control condition stimuli were constructed to present the participants with the identical experimental situations of the pre and post-testing stimuli in order to control for effects due to habituation to the stimuli. However, the participants made no judgment ratings but only responded with writing the nouns and verbs found within the experimental paragraphs. The writing of

the parts of speech found within the paragraphs was included to ensure that the participants read each situation. The control condition stimuli are presented in Appendix D and the order of presentation of the stimuli to the study participants is illustrated in Figure 1. Just as with the debiasing condition stimuli above, none of the experimental demand stimuli (Appendix E and Appendix F), described below, were presented within the control condition.

Experimental Demand Stimuli A second set of prediction stimuli were constructed to measure the possible changes in probability ratings due to the demand characteristics inherent within the debiasing procedure. The experimental demand stimuli were included as a manipulation check to ensure that any change in probability ratings of the threat stimuli was due to debiasing and not due to the experimental demand placed upon the participants to change their ratings.

The experimental demand stimuli were constructed to present the participants with six situations and outcomes for their probability judgment. The six situations were constructed to be related to the outcomes of games for two reasons. First, the game situations are relatively common and easy to imagine and judge. Second, the game situations

were generally unrelated to the positive and negative situations presented in the pre-testing and post-testing.

The game situations and outcomes are presented in Appendix E and Appendix F. Again, the order of presentation of the stimuli to the study participants is illustrated in Figure 1. The six game situations were randomly placed within the pre-testing and the post-testing experimental stimuli, with the stimuli placed within the pre-testing (Appendix E) and the stimuli placed within the post-testing (Appendix F) being identical with one notable exception. Specifically, as with the pre and post-testing experimental stimuli, half of the experimental demand stimuli were reverse scored. Thus, in the experimental demand stimuli, three questions were worded in terms of "what is the probability you will win" and three questions were worded in terms of "what is the probability you will lose." The opposite question for each situation was presented in the pre and post-testing.

The experimental demand stimuli were presented randomly within the pre and post-testing, resulting in a total of 26 items in each of the pre and post-testing phases of the experiment. Thus, each pre and post-testing consisted of the 20 positive and negative experimental stimuli plus the six experimental demand stimuli. However, the six experimental demand stimuli were not presented

within the control or debiasing treatment phase of the experiment in contrast to the 20 experimental stimuli.

This design created a measure of the demand characteristics inherent within the debiasing treatment. Specifically, if the study participants were responding to the experimental cues inherent within the debiasing procedure, then they would reduce their probability ratings on the post-testing experimental demand stimuli (Appendix F) and the post-testing experimental stimuli (Appendix B) equally. Conversely, if the study participants were responding to the debiasing procedure as hypothesized, then they would reduce their probability ratings on only the post-testing experimental stimuli (Appendix B) and not on the post-testing experimental demand stimuli (Appendix F). As illustrated in Figure 1, the experimental demand stimuli were not presented in the treatment phase of the experiment. Therefore, positive alternatives for these demand stimuli were not generated in the treatment phase of the experiment resulting in no activation of alternative information and a measure of the demand characteristics inherent within the debiasing procedure.

Debriefing Questions The debriefing questions were designed to assess for the possibility that the participants were responding to the experimental cues of the study. The debriefing questions were constructed to

assess whether the participant's perception of the purpose of the experiment was that they should have changed their probability ratings because that was what they thought the experiment was intended to find. The debriefing procedure has been utilized in previous studies for the assessment of demand characteristics (Schaller, Asp, Rosell, & Heim, 1996).

Specifically, the debriefing questions, presented in the Appendix G, were three multiple choice questions which explicitly ask the participants what they perceived as the purpose of the study. As illustrated in Figure 1, the debriefing questions were presented to all the study participants at the end of the experiment. These questions were used to group participants according to their perceptions of the purpose of the study to investigate demand characteristics.

The first debriefing question was used to categorize all participants into four groups, according to the four multiple choice answers. The groups included (1) participants who responded that the purpose of the study was to increase their threat probability ratings, (2) those who responded that the purpose was to decrease their threat probability ratings, (3) those who responded that the purpose was to make no changes in probability ratings, and finally (4) those who responded that they did not know the

purpose of the experiment. These groups were analyzed in combination with the ratings from the experimental demand stimuli to test for the impact of demand characteristics upon probability ratings.

Finally, the third debriefing question was also be used to group participants as a test of demand characteristics. Specifically, the question was used to categorize all participants into two groups, according to the two possible answers. The two groups included (1) participants who responded that they did notice a procedure that suggested the purpose of the experiment was to change their probability ratings because they were generating alternative ways the situations may end, and (2) those who responded that they did not notice such a procedure. Again, the groups were analyzed in combination with the ratings from the experimental demand stimuli to test for the impact of demand characteristics upon probability ratings.

Experimental Procedures

Undergraduate participants were recruited through sign-up sheets posted in the psychology department and through psychology classes at Texas Wesleyan University in Fort Worth, Texas. All participants were given extra credit for their undergraduate classes. The experiments were conducted in group settings either during scheduled

experiment times or at the end of undergraduate classes where permission was obtained from the class instructor. The students began the experiment by reading and signing the informed consent form (Appendix H). The informed consent form was read verbally by the experimenter to ensure understanding and all participants were given the opportunity to ask questions.

After consent was obtained, participants then completed a short demographic questionnaire and the trait form of the Spielberger State-Trait Anxiety Inventory (STAI: Spielberger et al., 1970). Participants were then randomly assigned to one of two experimental groups. The experimental groups included the control group and the debiasing group.

After randomization, participants were given a packet of information that included the experimental stimuli and directions for completion. The packet consisted of the 20 positive and negative experimental stimuli (Appendix A) and the six game-related demand stimuli (Appendix E), all randomly presented to the participants. The experimenter reviewed the instructions by reading the directions aloud while the participants followed on the written directions provided. Questions were answered by the experimenter and an example reviewed, then the participants were allowed to

complete the initial examination, the pre-testing. There was no time limit for completion of the instrument.

Following the completion of the pre-testing, each of the two experimental groups completed their respective tasks as outlined below in the treatment groups section. Following the completion of the experimental treatment, all participants again completed the experimental stimuli, the post-testing stimuli presented in the Appendix B and the Appendix F, in a similar fashion to the pre-testing. Again, the stimuli in the post-testing included the 20 positive and negative experimental stimuli (Appendix B) and the six game-related stimuli (Appendix F), all randomly presented to the participants. Finally, after completion of the post-testing stimuli, the participants were given the three debriefing questions presented in the Appendix G. Participants simply circled one response to each of the three questions. Upon completion of the debriefing questions, all materials were collected and extra credit were given to each participant.

Treatment Groups

The debiasing group completed the Consider-An-Alternative debiasing procedure (Hirt & Markman, 1995) as the treatment procedure in the pre-post experimental design. This procedure consisted of the presentation of the same 20 experimental situations as presented in the

pre-testing, followed by the generation of three alternative positive outcomes for each of the situations. Participants generated outcomes by simply writing three possible positive alternatives for the situation outcomes (Hirt & Markman, 1995; Mumma & Wilson, 1995). The stimuli for the debiasing group procedure are presented in Appendix C. It is important to note that none of the game-related experimental demand stimuli were presented during the debiasing treatment procedure.

The control group read the same 20 experimental situations as the debiasing group. However, instead of generating alternative positive outcomes, the participants wrote all of the nouns and verbs found in the situation paragraph. The recording of the parts of speech in the control group was included to ensure that the participants completely read each situation. The identical presentation of the 20 experimental situations was completed to control for any effects due to habituation. The stimuli for the control group procedure are presented in Appendix D. Again, it is important to note that none of the game-related experimental demand stimuli were presented during the control treatment procedure.

Experimental Design

The experimental design of the study was a 2 X 2 X 2 X 2 (Pre versus Post-Testing X Control versus Debiasing

Treatment X High versus "Normal" Anxiety X Male versus Female) repeated measures factorial design. The design included one within subject independent variable, the repeated measure, that consisted of the pre and post-testing ratings of the participant's probability estimates. The between subject independent variables included the two treatment groups (Control and Debiasing Groups), the two anxiety groups consisting of a high and a "normal" level of anxiety responsiveness, and the two gender groups. Thus, a total of four independent variables were included in the study.

The dependent variable for the study was the average score of the 10 threat probability ratings obtained from the pre and post-testing experimental stimuli. As stated earlier, only the ratings from the 10 negative (threat) experimental stimuli were utilized in the statistical analysis. The ten positive experimental stimuli were included to disguise the purpose of the study and were not included in the statistical analysis.

Statistical Analyses/Hypotheses

The analyses utilized in this study conducted several statistical procedures for the purpose of examining the experimental data. As a result, it is important to note that the overall experiment-wise error rate was considered, and the appropriate statistical procedures and alpha levels

chosen. For example, several mixed factorial Analysis of Variance statistical procedures were used to control for the elevation of Type I error. In addition, an alpha level of .05 was chosen as the level of significance for all statistical procedures, with one exception noted in the results section due to post-hoc testing. Specifically, a Bonferroni correction of the alpha level was made for post-hoc testing which resulted in a lower alpha level for the post-hoc analysis. All statistical findings falling above the alpha of .05 were noted as nonsignificant (NS), with the post-hoc analysis notation of nonsignificant results adjusted due to the Bonferroni correction of the alpha level as indicated in the results section.

Threat Ratings Analysis Probability ratings for each of the ten threat-related situations (Appendix A and Appendix B) were scored by recording the value of the participant's rating on the number lines. The responses from the five positively worded questions were reverse scored to obtain the pessimistic ratings for all five items. Then, all ten threat-related ratings were averaged to yield a mean threat probability rating for each participant. These data were utilized as the dependent variable in the statistical analysis investigating the threat ratings.

A mixed factorial 2 X 2 X 2 X 2 repeated measures analysis of variance (Pre versus Post-Testing X Control versus Debiasing Treatment X High versus "Normal" Anxiety X Male versus Female Gender) was conducted to test for differences in the four independent variables. In addition to testing for main effects for each independent variable, the repeated measures ANOVA allowed the testing of all interaction effects between the four independent variables.

It was hypothesized that highly anxious participants would report higher probability estimates of future threat-related events relative to participants with a "normal" level of anxiety responsiveness. Stated simply, a main effect for anxiety was expected. Second, it was hypothesized that a two-way interaction of treatment group and repeated measure upon threat probability ratings would be found. The debiasing procedure was expected to reduce threat probability ratings from pre to post-testing, while the control procedure was not expected to cause a systematic change in threat ratings. Therefore, the hypothesized interaction was expected to result in the post-testing probability ratings of the debiasing group to be significantly lower than the ratings of the control group (pre and post-testing) and the pre-testing ratings of the debiasing group. Finally, it was hypothesized that a two-way interaction of gender and anxiety upon threat

probability ratings would be found. Highly anxious female participants were expected to show greater pessimistic predictions of future threat than all male participants and female participants with a lower level of anxiety responsiveness.

A main effect for trait anxiety was expected because of previous studies that have found increased pessimistic predictions of future threat associated with higher levels of anxiety (Bentz & Williamson, 1998; Bentz et al., 1999). The two-way interaction of treatment group and repeated measure upon threat probability ratings was expected because of previous investigations that have found the Consider-An-Alternative debiasing procedure to be effective in the reduction of judgmental errors (Hirt & Markman, 1995; Mumma & Wilson, 1995). Finally, the two-way interaction of gender and anxiety upon threat probability ratings was expected due to previous studies that have shown this interaction (Bentz & Williamson, 1998; Bentz et al., 1999).

Demand Ratings Analysis A second analysis was conducted to test for effects due to demand characteristics inherent within the debiasing procedure. Specifically, the data collected from the six experimental demand stimuli (Appendix E and Appendix F) were analyzed as a separate dependent variable. Probability ratings from each of the

six game-related situations were scored and averaged in a similar fashion to the experimental stimuli to yield a mean experimental demand probability rating for each participant.

The use of the experimental demand ratings as the dependent variable created a new independent variable. Specifically, the control versus debiasing independent variable of the threat ratings analysis was changed to a demand versus no demand independent variable. This change was accomplished because the game-related dependent variable of the demand ratings analysis was not presented during the treatment phase of the repeated measure design (Figure 1). Thus, a new independent variable was created that measured the changes in probability ratings due to the experimental cues inherent within the treatment procedure.

As explained earlier in the section devoted to the experimental demand stimuli, if the study participants were responding to the experimental cues inherent within the debiasing procedure, then they would reduce their probability ratings on the post-testing experimental demand stimuli (Appendix F) and the post-testing experimental stimuli (Appendix B) equally. The experimental cues of the debiasing procedure would decrease the ratings of both the threat and game-related stimuli, even though the

participants were not generating positive alternatives for the game-related stimuli.

Conversely, if the study participants were responding to the debiasing procedure as hypothesized, then they would reduce their probability ratings on only the post-testing experimental stimuli (Appendix B) and not on the post-testing experimental demand stimuli (Appendix F). In this case, the debiasing procedure of generating positive alternatives would decrease the probability ratings of only the threat-related stimuli because positive alternatives were not generated for the game-related stimuli.

Thus, the analysis of the threat-related ratings examined the effects of the treatment procedure. Furthermore, the analysis of the game-related ratings examined the effects of the experimental demand within the treatment procedure. The current demand ratings analysis uses only the game-related ratings as the dependent variable and therefore the independent variable of control versus debiasing treatment is converted to a demand versus no demand independent variable.

A similar 2 X 2 X 2 X 2 repeated measures analysis of variance (Pre versus Post-Testing X Demand versus No Demand Treatment X High versus "Normal" Anxiety X Male versus Female Gender) was utilized for the analysis. The independent variables for the analysis again included one

within subject and three between subject variables. The within subject variable was the repeated measure (pre and post-testing) of experimental demand stimuli. The three between subject variables included (1) the two treatment groups consisting of a demand group versus a no demand group, (2) the two anxiety groups consisting of a high and "normal" level of anxiety responsiveness, and finally (3) gender. The dependent variable was the average participant probability ratings for the experimental demand stimuli.

The demand group consisted of all participants within the debiasing group in the previous threat ratings analysis. However, since the experimental demand stimuli were not presented during the treatment phase of the study (Figure 1), the dependent variable in the current analysis was a measure of the changes in probability ratings due to experimental cues. Stated simply, the new dependent variable, mean demand probability ratings, created one treatment group in which experimental demand was present and one treatment group in which the demand was absent. This was achieved because the participants in the demand group completed the debiasing procedure, but they did not generate positive alternatives for the six game-related experimental demand stimuli. Therefore, the demand group participants were presented with the experimental cues inherent within the debiasing procedure, but they did not

generate positive alternatives for the six experimental demand stimuli.

Conversely, the participants in the no demand group did not complete the debiasing procedure and therefore they were not presented the experimental cues inherent within the procedure itself. However, the design of the statistical analysis was the same in comparison to the analysis of the previous threat-related stimuli, with the exception of the different dependent variable.

For the demand ratings analysis, it was again hypothesized that highly anxious participants will report higher probability estimates of future game-related loss relative to participants with a "normal" level of anxiety responsiveness. This finding was expected to be found with a main effect for anxiety. In addition, it was again hypothesized that a two-way interaction of gender and anxiety upon demand probability ratings would be found. This interaction was expected to result in highly anxious female participants reporting the highest pessimistic probability ratings in comparison to all male participants and female participants with a lower level of anxiety responsiveness. Finally, it was hypothesized that there would be no main effects or interaction effects involving the repeated measure and the experimental demand independent variable.

The main effect for anxiety was again expected because of previous studies that have found increased pessimistic predictions of future negative events associated with higher levels of anxiety responsiveness (Bentz & Williamson, 1998; Bentz et al., 1999). In addition, the two-way interaction of gender and anxiety upon demand probability ratings was expected because of previous investigations that have found highly anxious female participants with the greatest pessimistic ratings of future events (Bentz & Williamson, 1998; Bentz et al., 1999). Finally, null finding for experimental demand was expected because demand characteristics have not been found to result in a reduction of judgmental errors (Sharpe & Adair, 1993).

Debriefing Ratings Analysis A third analysis was conducted using the debriefing questions (Appendix G) to group the study participants into categories of subjects with different perceptions of the purpose of the study. This final analysis used the same dependent variable as in the second analysis, mean experimental demand ratings, except the study participants were grouped according to their perceptions of the purpose of the experiment. Two separate analyses, using the first and third debriefing questions to group the participants, were conducted. The debriefing ratings analysis can be viewed as two secondary

statistical procedures conducted to verify any effects due to demand characteristics that were found in the demand ratings analysis.

However, before any regrouping of participants was completed, it was important to justify the collapsing of participants across treatment groups. Specifically, it was important to establish that an approximately equal number of participants from the control and debiasing treatment groups responded to each of the four alternative responses of the first debriefing question. This was important because it was possible that a majority of participants from the control or debiasing groups responded to just one of the alternative responses. In other words, it was possible that the participants from the control or debiasing groups all had the same perception as to the purpose of the experiment. If this was true, then regrouping of participants for the debriefing analysis would be inconsequential because the majority of participants would fall into only one of the four groups of perceived purpose of the experiment. Any statistical analysis using a grouping of participants according to this pattern of response would have misleading findings because a majority if the variability would fall into only one group.

As a result, a 2 X 4 chi-square analysis was conducted to test the proportion of participants from the control and debiasing groups who responded to each of the four alternative responses of the first debriefing question. If an approximately equal number of participants endorsed each response, then the collapsing of participants across treatment group and regrouping according to the participant's responses to the debriefing question could be justified.

Once the regrouping was justified, participants were grouped into four categories of subjects using the responses from the first debriefing question. Specifically, the four groups included participants who perceived the purpose of the experiment to (1) increase their probability ratings, (2) decrease their probability ratings, (3) make no changes in their probability ratings, and (4) those who did not know the purpose of the experiment.

The subgroups were used in a 4 X 2 X 2 X 2 (Four Perceived Demand Groups X Repeated Measure X Anxiety X Gender) repeated measures analysis of variance. The independent variables for the analysis included (1) the four groups of participants categorized according to their perceptions of the purpose of the experiment, (2) the mean pre versus post demand probability ratings, (3) the high

versus "normal" levels of anxiety responsiveness, and (4) the male versus female participants. The dependent variable for the repeated measures ANOVA was the same mean demand probability ratings used in the second analysis.

It was hypothesized that highly anxious participants would report higher probability estimates of future game-related loss relative to participants with a "normal" level of anxiety responsiveness. This finding was expected to be found with a main effect for anxiety. In addition, it was hypothesized that a two-way interaction of gender and anxiety upon demand probability ratings will be found. This interaction was expected to result in highly anxious female participants showing the highest probability ratings in comparison to all male participants and female participants with a "normal" level of anxiety responsiveness. Finally, it was hypothesized that there would be no main effects or interaction effects involving the repeated measure and the four demand groups. A null finding for this analysis was expected because demand characteristics have not been found to result in a reduction of judgmental errors (Sharpe & Adair, 1993).

Lastly, using the responses from the third debriefing question, participants were grouped into two categories of subjects. Specifically, the two groups included (1) participants who noticed a procedure within the experiment

which suggested the purpose of the experiment was to change their probability ratings, and (2) participants who did not notice such a procedure.

The groups were used in a 2 X 2 X 2 X 2 (Perceived Demand Groups X Repeated Measure X Anxiety X Gender) repeated measures analysis of variance. The independent variables for the analysis included (1) the two groups of participants categorized according to their perceptions of the purpose of the experiment, (2) the mean pre versus post demand probability ratings, (3) the high versus "normal" levels of anxiety responsiveness, and (4) the male versus female participants. The dependent variable for the repeated measures ANOVA was the same mean demand probability ratings used in the second analysis.

Again, it was hypothesized that highly anxious participants would report higher probability estimates of future game-related loss relative to participants with a "normal" level of anxiety responsiveness. This finding was expected to be found with a main effect for anxiety. In addition, it was again hypothesized that a two-way interaction of gender and anxiety upon demand probability ratings would be found. This interaction was expected to result in highly anxious female participants showing the highest probability ratings in comparison to all male participants and female participants with a "normal" level

of anxiety responsiveness. Finally, it was hypothesized that there would be no main effects or interaction effects involving the repeated measure and the two demand groups. A null finding for this analysis was expected because demand characteristics have not been found to result in a reduction of judgmental errors (Sharpe & Adair, 1993).

Results

Threat Ratings Results

Probability ratings for each of the ten threat-related situations (Appendix A and Appendix B) were scored by recording the value of the participant's rating on the number lines. The responses from the five positively worded questions were reverse scored to obtain the pessimistic ratings for all five items. Then, all ten threat-related ratings were averaged to yield a mean threat probability rating for each participant's pre and post testing. These data were utilized as the repeated measure dependent variable in the statistical analysis investigating the threat ratings.

A mixed factorial 2 X 2 X 2 X 2 repeated measures analysis of variance (Pre versus Post-Testing X Control versus Debiasing Treatment X High versus "Normal" Anxiety X Male versus Female Gender) was conducted to test for differences in the four independent variables. In addition to testing for main effects of each independent variable, the repeated measures ANOVA allowed the testing of all interaction effects among the independent variables. It was hypothesized that the analysis would find a main effect for anxiety, a two-way interaction of gender and anxiety, and finally a two-way interaction of treatment group and repeated measure.

Significant main effects were found for three of the four independent variables. As hypothesized, a main effect for anxiety group was found ($F[1,124] = 13.35$, $p < .001$). The average threat probability rating for the highly anxious group (mean = 49.79%, $SD = 13.20$) was found to be significantly greater than the "normal" group (mean = 42.41%, $SD = 14.58$) indicating higher threat-related likelihood ratings from the highly anxious participants. Second, a significant main effect for gender was found ($F[1,124] = 47.00$, $p < .001$). The average threat probability rating for female participants (mean = 53.03%, $SD = 13.07$) was found to be significantly higher than male participants (mean = 39.18%, $SD = 11.65$). Finally, a significant main effect for the treatment group was found ($F[1,124] = 12.70$, $p < .001$). The average threat probability rating for the control group (mean = 49.70%, $SD = 14.38$) was found to be significantly greater than the debiasing group (mean = 42.50%, $SD = 13.07$). The main effect for the repeated measure was found to be nonsignificant ($F\{1,124] = 0.58$, p = NS).

All possible interaction effects between the four independent variables were tested in the repeated measures ANOVA. As hypothesized, a significant interaction of treatment group and repeated measure upon threat probability ratings was found ($F[1,124] = 22.88$, $p < .001$).

The average threat probability ratings for each of the four groups involved in the two-way interaction were as follows; Pre-testing Control group (mean = 49.09%, SD = 14.05), Post-testing Control group (mean = 52.48%, SD = 16.07), Pre-testing Debiasing group (mean = 45.13%, SD = 13.86), and Post-testing Debiasing group (mean = 40.29%, SD = 14.28). The interaction of treatment group and repeated measure is illustrated in Figure 2. The repeated measure independent variable is presented on the X-axis of Figure 2 while the two treatment groups are presented by the separate bars. The dependent variable is presented on the Y-axis.

A post-hoc analysis of the simple effects was conducted to determine the exact results within the interaction. A total of four t-tests were conducted which were Bonferroni corrected to control for the increase in Type I error. Thus, the result of this correction was an alpha of 0.0125 which was used as the level of significance for the four t-tests. Two independent samples t-tests were conducted to examine the control versus debiasing group ratings for both the pre and post-testing. In addition, two paired samples t-tests were conducted to examine the pre versus post-testing ratings for both the control and debiasing groups. The paired samples t-tests were required

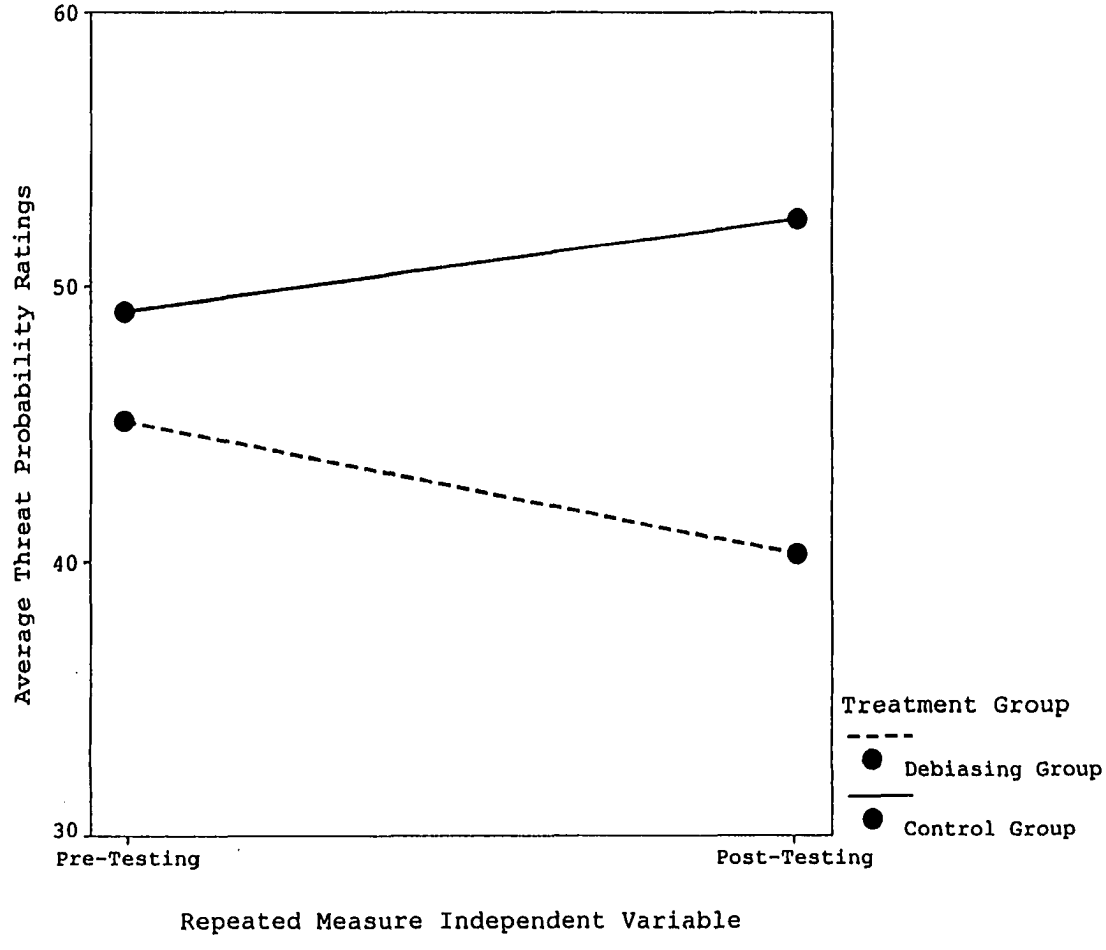

Figure 2

Plot of the interaction effect of treatment group and repeated measure upon the threat probability ratings.

because the repeated measure pre and post-testing ratings violated the assumption of independence of samples.

The difference between the control versus debiasing group ratings of the pre-testing was found to be nonsignificant (t[130] = -1.63, p = NS). Average threat probability ratings for the treatment groups were initially found to be equivalent. However, at post-testing the control versus debiasing group ratings differed significantly (t[130] = 4.58, p < .001). The paired samples analysis revealed that the debiasing group ratings significantly decreased (t[61] = -3.67, p < .001) and the control group ratings significantly increased (t[69] = 3.08, p < .005) from pre to post-testing.

All other interaction effects between the independent variables within the repeated measures ANOVA were tested and found to be nonsignificant. The test results for each of the nonsignificant interaction effects were as follows; Anxiety Group X Gender (F[1,124] = 0.34, p = NS), Anxiety Group X Treatment Group (F[1,124] = 0.05, p = NS), Anxiety Group X Repeated Measure (F[1,124] = 0.85, p = NS), Gender X Repeated Measure (F[1,124] = 2.42, p = NS), Gender X Treatment Group (F[1,124] = 0.44, p = NS), Anxiety Group X Gender X Treatment Group (F[1,124] = 0.74, p = NS), Anxiety Group X Gender X Repeated Measure (F[1,124] = 0.23, p = NS), Anxiety Group X Treatment Group X Repeated Measure

(F[1,124] = 0.06, p = NS), Gender X Treatment Group X Repeated Measure (F[1,124] = 1.01, p = NS), Anxiety Group X Gender X Treatment Group X Repeated Measure (F[1,124] = 0.83, p = NS).

Demand Ratings Results

The second set of data was collected to investigate the possibility that any systematic change in probability ratings was simply due to demand characteristic factors. A set of game-related situations was developed to evaluate the ratings of several non-threatening situations. Specifically, the data collected from the six experimental demand stimuli (Appendix E and Appendix F) were used as a separate dependent variable. Probability ratings from each of the six game-related situations were scored and averaged in a similar fashion to the experimental stimuli. Positive questions were reverse scored then all six ratings were summed and averaged to yield a mean experimental demand probability rating for each participant's pre- and post testing ratings. These data were then utilized as the repeated measure dependent variable in the statistical analysis investigating demand ratings.

A similar 2 X 2 X 2 X 2 repeated measures analysis of variance (Pre versus Post-Testing X Demand versus No Demand X High versus "Normal" Anxiety X Male versus Female Gender) was conducted. The design was identical to the previous

threat ratings analysis with the exception of the change in the dependent variable to the game-related experimental demand stimuli.

The inclusion of the game-related dependent variable converted the control versus debiasing treatment independent variable of the previous threat-related analysis to the current demand versus no demand independent variable. As described earlier, this conversion was an appropriate control for the measurement of experimental demand within the treatment procedure because the game-related stimuli were not administered to the participants during the treatment phase of the experiment. Thus, the game-related dependent variable measured the change in probability ratings due to the experimental cues within the treatment phase of the experiment. It was hypothesized that the analysis would find a main effect for anxiety and a two-way interaction of gender and anxiety. In addition, it was hypothesized that there would be no main effect or interaction effects found involving the repeated measure.

The results indicated that there was a significant main effect for the repeated measure ($F[1,124] = 4.22$, $p < .05$). The average game-related probability ratings were found to be significantly higher for the post-testing (mean = 49.60%, $SD = 12.15$) in comparison to the pre-testing (mean = 47.74%, $SD = 10.52$). All three other main effects

were found to be nonsignificant including the main effects for anxiety group ($F[1,124] = 2.83$, p = NS), gender ($F[1,124] = 0.01$, p = NS), and treatment group ($F[1,124] = 1.32$, p = NS).

All possible interaction effects of the four independent variables were tested and all were found to be nonsignificant. The test results for each of the nonsignificant interaction effects were as follows; Anxiety Group X Gender ($F[1,124] = 0.18$, p = NS), Anxiety Group X Treatment Group ($F[1,124] = 1.64$, p = NS), Gender X Treatment Group ($F[1,124] = 1.42$, p = NS), Anxiety Group X Repeated Measure ($F[1,124] = 0.08$, p = NS), Gender X Repeated Measure ($F[1,124] = 0.18$, p = NS), Treatment Group X Repeated Measure ($F[1,124] = 1.76$, p = NS), Anxiety Group X Gender X Treatment Group ($F[1,124] = 1.34$, p = NS), Anxiety Group X Gender X Repeated Measure ($F[1,124] = 1.98$, p = NS), Anxiety Group X Treatment Group X Repeated Measure ($F[1,124] = 0.08$, p = NS), Gender X Treatment Group X Repeated Measure ($F[1,124] = 1.60$, p = NS), Anxiety Group X Gender X Treatment Group X Repeated Measure ($F[1,124] = 2.23$, p = NS).

Debriefing Ratings Results

Finally, a third statistical analysis was conducted to again test for effects due to demand characteristics inherent within the debiasing procedure. Identically to

the demand ratings analysis, the data collected from the six experimental demand stimuli (Appendix E and Appendix F) were analyzed as the repeated measure dependent variable. However, two debriefing questions (Questions Number 1 and 3) were used as grouping variables to categorize participants according to their perceptions of the purpose of the study.

These final statistical procedures can be viewed as two additional analyses to investigate the influence of demand characteristics upon future probability ratings. Instead of using the experimental grouping of the treatment manipulation, the debriefing questions were used to categorize participants into groups according to their perceptions of the purpose of the experiment. Thus, the analyses of the demand data was completed in order to examine the participant's game-related probability ratings as a function of their perception of the purpose of the study. This analysis was achieved by collapsing all participants within the demand and no demand groups, then separating the participants according to their self-reported perceived purpose of the study (Debriefing Questions 1 and 3).

However, as described earlier it was important to justify the separation of participants and verify that participants responded to the debriefing questions with

different perceptions of the purpose of the experiment. This verification was needed because it was possible that a large portion of participants responded to only one of the four answers.

A 2 X 4 chi-square analysis was conducted to achieve this verification. The proportion of participants from the demand and no demand groups were compared for each of the four possible responses to the first debriefing question. No significant difference in the proportion of participants was found (chi-square = 0.626, p = NS). Thus, an approximately equal number of participants endorsed each of the four possible responses of the first debriefing question. This finding justifies the collapsing of participants across treatment group and regrouping according to their self-reported perception of the purpose of the study. The collapsing and regrouping of participants is justified because, as explained earlier, an approximately equal number of participants was needed in each of the four possible groups. Without this equal distribution of participants, the debriefing analysis results could be inconsequential because a majority of the data variability would fall into only one of the perceived purpose groups.

The first analysis used the responses from the first debriefing question to group participants into four

categories of subjects. Specifically, the four groups included participants who perceived the purpose of the experiment to (1) increase their probability ratings, (2) decrease their probability ratings, (3) make no changes in their probability ratings, and (4) those who did not know the purpose of the experiment.

The groups were used in a 4 X 2 X 2 X 2 (Four Perceived Demand Groups X Repeated Measure X Anxiety X Gender) repeated measures analysis of variance. The four independent variables and all possible interaction effects were tested for statistical significance in the repeated measures ANOVA. As stated earlier, it was hypothesized that there would be a main effect for anxiety and a two-way interaction of gender and anxiety. In addition, it was hypothesized that there would be no main effect or interaction effects involving the repeated measure.

The results showed a significant main effect for the repeated measure ($F[1,116] = 5.74$, $p < .05$). The average game-related demand ratings of the post-testing (mean = 49.60%, SD = 12.15) were found to be significantly higher than the ratings of the pre-testing (mean = 47.74%, SD = 10.52). The three remaining main effects were all found to be nonsignificant including the main effect for anxiety group ($F[1,116] = 0.89$, p = NS), gender ($F[1,116] = 0.00$, p = NS), and demand group ($F[3,116] = 0.53$, p = NS).

All interaction effects involving the four independent variables were tested and found to be nonsignificant. The test results for each of the nonsignificant interaction effects were as follows; Anxiety Group X Gender ($F[1,116] = 0.01$, p = NS), Anxiety Group X Demand Group ($F[3,116] = 0.70$, p = NS), Gender X Demand Group ($F[3,116] = 0.55$, p = NS), Anxiety Group X Repeated Measure ($F[1,116] = 0.62$, p = NS), Gender X Repeated Measure ($F[1,116] = 0.63$, p = NS), Demand Group X Repeated Measure ($F[3,116] = 0.42$, p = NS), Anxiety Group X Gender X Demand Group ($F[3,116] = 2.06$, p = NS), Anxiety Group X Gender X Repeated Measure ($F[1,116] = 0.54$, p = NS), Anxiety Group X Demand Group X Repeated Measure ($F[3,116] = 1.59$, p = NS), Gender X Demand Group X Repeated Measure ($F[3,116] = 0.42$, p = NS), Anxiety Group X Gender X Demand Group X Repeated Measure ($F[3,116] = 1.14$, p = NS).

Finally, the responses from the third debriefing question were used in the last repeated measures ANOVA to group participants into two categories of subjects. Specifically, the two groups included (1) participants who noticed a procedure within the experiment which suggested the purpose of the experiment was to change their probability ratings, and (2) participants who did not notice such a procedure.

The groups were then used in a 2 X 2 X 2 X 2 (Perceived Demand Group X Repeated Measure X Anxiety X Gender) repeated measures analysis of variance. The four independent variables and all possible interaction effects were tested for statistical significance. It was again hypothesized that there would be a main effect for anxiety and a two-way interaction of gender and anxiety. In addition, it was hypothesized that there would be no main effect or interaction effects involving the repeated measure.

All four main effects were found to be nonsignificant including the main effect for anxiety ($F[1,124] = 2.06$, p = NS), gender ($F[1,124] = 0.35$, p = NS), demand group ($F[1,124] = 0.41$, p = NS), and repeated measure ($F[1,124] = 2.99$, p = NS). However, the repeated measure main effect approached significance.

All interaction effects involving the four independent variables were tested and found to be nonsignificant. The test results of the nonsignificant interaction effects were as follows; Anxiety X Gender ($F[1,124] = 0.00$, p = NS), Anxiety X Demand Group ($F[1,124] = 0.05$, p = NS), Gender X Demand Group ($F[1,124] = 1.06$, p = NS), Anxiety X Repeated Measure ($F[1,124] = 0.01$, p = NS), Gender X Repeated Measure ($F[1,124] = 0.10$, p = NS), Demand Group X Repeated Measure ($F[1,124] = 0.24$, p = NS), Anxiety X Gender X

Demand Group (F[1,124] = 0.16, p = NS), Anxiety X Gender X Repeated Measure (F[1,124] = 0.47, p = NS), Anxiety X Demand Group X Repeated Measure (F[1,124] = 0.59, p = NS), Gender X Demand Group X Repeated Measure (F[1,124] = 0.12, p = NS), Anxiety X Gender X Demand Group X Repeated Measure (F[1,124] = 1.76, p = NS).

Discussion

It was the goal of the current study to investigate one debiasing technique, the Consider-An-Alternative procedure (Hirt & Markman, 1995), and its ability to reduce the judgmental errors which have been shown to be associated with higher levels of anxiety (Bentz & Williamson, 1998). In addition, a rival hypothesis of demand characteristics was examined as a possible explanation of any findings of the reduction of judgmental errors.

The findings provide support for several conclusions involving a judgmental bias associated with anxiety, the reduction of the judgmental bias, and the role demand characteristics has in the study of the bias. First, the pessimistic judgment of future events associated with anxiety was replicated (Bentz & Williamson, 1998; Bentz et al., 1999). Second, the Consider-An-Alternative debiasing procedure (Hirt & Markman, 1995) was shown to be an effective technique in the reduction of the judgmental bias. Finally, experimental demand was shown to be associated with changes in probability judgments. However, demand characteristics could not explain the reduction in the judgmental errors.

It is important to note for the purpose of the discussion section that equivalent baseline threat and

game-related ratings were needed. Equivalent baseline ratings establishes a ratings level from which changes in prediction ratings could be demonstrated. Thus, for the purpose of experimental control, it was desirable that the groups did not differ at baseline. The results showed that baseline ratings were equivalent for both the threat and game-related ratings. Therefore, it can be concluded that the initial, pre-testing, levels of threat and game-related probability ratings were equivalent, allowing the subsequent analysis of changes due to the treatment procedure.

Threat Ratings Discussion

In review, the results of the statistical analysis on the threat ratings indicated three significant main effects for anxiety group, gender, and treatment group. In addition, the analysis found one two-way interaction of treatment group and repeated measure. It was hypothesized that there would be a main effect for anxiety group, a two-way interaction of gender and anxiety, and a second two-way interaction of treatment group and repeated measure.

First, it was found that highly anxious participants rated the likelihood of future negative events more pessimistically than participants with a "normal" level of anxiety responsivity. As hypothesized, a high level of anxiety was found to be associated with higher ratings of

future threat. This result is consistent with several previous studies that have found greater pessimistic predictions of future negative events associated with higher levels of anxiety (Bentz & Williamson, 1998; Bentz et al., 1999; Butler & Mathews, 1983; MacLeod & Byrne, 1996). In addition, it supports the conclusion that higher levels of anxiety are associated with biased judgments of the likelihood of future threat.

Second, it was found that female participants rated the likelihood of future negative events more pessimistically than male participants. It was hypothesized that a two-way interaction of gender and anxiety upon threat probability ratings would be found due to similar findings in two previous studies (Bentz & Williamson, 1998; Bentz et al., 1999). However, no such interaction was found in the current study.

The previous interaction results of Bentz and Williamson (1998) and Bentz et al. (1999) indicated that highly anxious women predict the likelihood of future threatening events as more probable than male participants and female participants with lower levels of anxiety. The current results indicated that all female participants, regardless of level of anxiety, rated the likelihood of future threat as more probable than male participants. Thus, the change in findings across these studies was due

to an increase in pessimistic probability ratings among female participants with a lower level of anxiety in comparison to male participants.

This change in results could be explained by methodological differences between the studies. Specifically, the two previous studies (Bentz & Williamson, 1998; Bentz et al., 1999) that found a gender by anxiety interaction utilized a multiple regression experimental design. In addition, the independent variable, level of anxiety, included a wide range of anxiety responsivity, i.e. extreme levels of high and low trait anxiety. It was found that as anxiety level increased, the difference between the probability ratings of male and female participants also increased. Thus, it is likely that the regression design of the two previous studies found an interaction of gender and anxiety because the male and female participants with extremely low levels of anxiety showed no prediction differences. Furthermore, participants who scored more moderately on the measure of anxiety made threat probability ratings that showed increasing difference between the genders (Bentz & Williamson, 1998; Bentz et al., 1999).

In the current study, the anxious comparison group was designed to be of a more moderate or "normal" level of anxiety responsivity. Thus, the anxiety comparison group

included male and female group members who were above the extremely low level of trait anxiety used in the previous two studies. It is possible that this methodological difference resulted in the main effect for anxiety due to the sufficient gender difference in probability ratings among the "normal" anxiety group.

This result is not in direct opposition to the findings of Bentz and Williamson (1998) and Bentz et al. (1999). However, it does suggest that the previous interaction results were primarily due to the inclusion of extremely low trait anxious participants in the two studies. Thus, it is likely that gender remains a moderating variable in the association between anxiety and a judgmental cognitive bias. Therefore, as suggested by Bentz et al. (1999), it is recommended that gender be included in future studies investigating this association, particularly when the study sample includes participants with extremely low levels of anxiety responsivity.

Third, it was found that participants within the control group rated the likelihood of future negative events as more likely than participants within the debiasing group. The average threat probability ratings of the control group were significantly higher than the average ratings of the debiasing group. However, as illustrated in Figure 2 the difference between the

debiasing and control groups is primarily accounted for by the post-testing ratings. Thus, an explanation of the main effect for treatment group must be accomplished with the following discussion of the two-way interaction involving the treatment group and repeated measure independent variables.

Finally, a significant two-way interaction of treatment group and repeated measure upon threat probability ratings was found. As illustrated in Figure 2, the threat ratings of the control group showed a positive trend with increasing likelihood ratings from pre to post testing. Furthermore, the threat ratings of the debiasing group showed a negative trend with decreasing likelihood ratings from pre to post testing.

Post-hoc analysis of the simple effects within the two-way interaction confirmed these trends. The control group threat probability ratings significantly increased from the pre to the post-testing. The debiasing group threat probability ratings were significantly reduced from the pre to the post-testing. In addition, the pre-testing ratings were equivalent for both the control and debiasing groups confirming equal baseline ratings for the threat-related analysis. Finally, the post-testing ratings of the control group were significantly higher than the debiasing group. It is concluded that these findings are generally

supportive of the effectiveness of the Consider-An-Alternative debiasing procedure (Hirt & Markman, 1995) in the reduction of judgmental errors.

The main evidence in support of this conclusion is the decrease in threat probability ratings of the debiasing group from pre to post testing. The Consider-An-Alternative debiasing procedure decreased participant ratings of the likelihood of future threatening events as was expected. The control group did not show a similar decrease in likelihood ratings, leading to the conclusion that the reduction in ratings was due to the treatment procedure.

In addition, the finding of a reduction in threat-related probability ratings in the debiasing treatment group was equivalent across anxiety level. This finding suggests that the Consider-An-Alternative debiasing procedure was effective in the reduction of judgmental errors regardless of the level of anxiety. Therefore, the debiasing procedure may be applicable to the reduction of judgmental errors in prediction situations for not only highly anxious individuals but also individuals that have a more moderate level of anxiety responsivity.

An increase in threat probability ratings of the control group was also found and requires further discussion. The control group was presented a procedure

during the treatment phase of the experiment that consisted of reading the same stimuli and recording the nouns and verbs found within each paragraph. This procedure was conducted in order to control for effects due to habituation. It is possible that participants within the control group actually read each paragraph more than once during their recording of the parts of speech. This repetition of the negative situations then would have resulted in further activation of threat information, ultimately leading to increased probability estimates.

This explanation of the increased probability ratings in the control group due to the repetition of the stimuli is supported by the previous research of Weinstein and Klien (1995). As described earlier, the authors investigated four debiasing procedures in an attempt to reduce health risk judgments. All procedures were unsuccessful in reducing the judgmental bias and, more importantly, the two procedures that forced participants to focus on the health risks actually resulted in an exaggerated bias. Thus, Weinstein and Klien (1995) showed that the repetition of the health risks information increased judgment errors. In the same way, it is possible that the control group in the current study may have increased the threat probability estimates due to the repetition of the negative stimuli. This explanation is

speculative since there was no way to measure the number of times each participant read each scenario.

In summary, several important findings from the threat ratings analysis were made. First, the findings offer additional evidence that level of anxiety responsivity is associated with the biased judgment of future negative events (Bentz & Williamson, 1998; Bentz et al., 1999; Butler & Mathews, 1983; MacLeod & Byrne, 1996). Second, female participants were found to have more pessimistic future predictions than male participants. Although an interaction of gender and anxiety was hypothesized, it is likely that methodological differences between the studies can account for this change in results.

Third, it was found that participants within the control group rated the likelihood of future negative events as more likely than participants within the debiasing group. However, this main effect for treatment group is primarily accounted for by the two-way interaction of treatment group and repeated measure upon threat probability ratings. Close examination of the interaction effect showed that, as hypothesized, a decrease in probability ratings from pre to post testing was found for the debiasing group. This finding is supportive of the effectiveness of the Consider-An-Alternative debiasing procedure (Hirt & Markman, 1995) in the reduction of

judgmental errors. In addition, it was found that the highly anxious and "normal" groups responded equivalently to the debiasing intervention. Finally, the two-way interaction also showed an increase in threat probability ratings of the control group which may be attributable to repetition of the negative stimuli resulting in the exaggerated judgmental bias.

Demand and Debriefing Ratings Discussion

In review, the statistical analyses involving the game-related demand stimuli and the debriefing questions included three separate procedures that grouped participants according to their perceptions of the purpose of the study. In the first and the second procedures, a main effect was found for the repeated measure. The game-related post-testing probability ratings of the participants were found to be significantly higher than the pre-testing ratings. All other main effects and interaction effects in the three analyses were found to be nonsignificant.

It was hypothesized that the three statistical procedures would each find a main effect for anxiety, an interaction of gender and anxiety, and no main effects or interaction effects involving the repeated measure. It was the objective of the three analyses to investigate demand characteristics as a rival hypothesis to any finding of the

reduction in judgmental errors associated with the debiasing procedure.

The two findings of a main effect for the repeated measure confirms that experimental demand was associated with increased probability ratings from the pre to the post-testing. As will be discussed later, this finding supports the conclusion that experimental cues within the informed consent or instructions led to the increase in probability ratings, not the experimental cues within the debiasing procedure.

The three analyses failed to find a main effect for anxiety. Stated simply, there was no significant difference found between highly anxious and "normal" participants on the game-related likelihood ratings. It was hypothesized that there would be found a main effect for anxiety because previous studies have demonstrated an association between anxiety and a prediction bias (Bentz & Williamson, 1998; Bentz et al., 1999).

One possible explanation for this failure to find a main effect for anxiety is that the study participants may have viewed the game-related events as situations that had random outcomes or situations in which they had very little control over the outcome. As a result, the study participants, regardless of their level of anxiety, may have made their ratings around 50% and reduced the

variability of the game-related ratings, a central tendency response bias. If the study participants perceived the game situations in this way, then it would have been possible that no difference in game-related probability ratings would have been found between the anxiety groups.

Close examination of the pre and post ratings of both the threat-related and the game-related ratings showed an overall pattern that supports this conclusion. In general, the average game-related ratings were closer to 50% and showed lower variability than the threat-related ratings suggesting that there may have been a central tendency response bias. However, the fact that two main effects were found involving the repeated measure suggests that decreased variability of the dependent variable was not the cause of this null finding.

In hindsight, it would have been helpful to include a third phase to the pilot study to verify the game-related stimuli as an adequate measure for the comparison of demand characteristics. For example, a small experiment could have been conducted using undergraduate students randomly assigned to a demand group and a no demand group in a similar repeated measure pre-post experimental design. The demand group would have completed the game-related stimuli as a pre-testing. Then, the demand group participants would have received some instructions informing them that

the purpose of the experiment was to influence them to make their ratings as low as possible. The demand group would then have received the same game-related stimuli again as a post-testing.

The no demand group would also have completed the game-related stimuli as a pre-testing. However, this group would then have received some distractor task that approximated the time that it took the demand group to receive their instructions. The no demand group would then have received the game-related stimuli again as a post-testing. These data would have been analyzed in a 2 X 2 repeated measures ANOVA.

If the game-related stimuli were perceived by all the participants as events in which they had very little control, thus leading to a central tendency response bias, then the analysis would find no main effects or interaction effects involving the two independent variables. If, on the other hand, the game-related stimuli were an adequate measure of the experimental demand, then the analysis would find an interaction of the repeated measure and the demand group. A pilot study such as this would have clearly established the game-related stimuli as an adequate measure to allow the comparison of experimental demand.

A second possible explanation for the failure to find a main effect for anxiety is the content specificity

hypothesis. Specifically, the theory as originally described by Beck and Emory (1985) proposes that emotional problems of an individual determine the content of the information processing errors that are most common for that individual. Therefore, since the game-related prediction stimuli have very little similarity in content to the threat-related information processing errors associated with anxiety, a main effect for anxiety would not be found. Stated simply, it is possible that the highly anxious participants had no judgmental bias when completing the game-related predictions because the content of the stimuli did not activate the error.

Prior research on the content specificity of a judgmental bias associated with anxiety is sparse. In the only study that directly investigated the phenomena, Bentz et al. (1999) presented findings that were generally supportive of the content specificity of judgmental errors associated with anxiety. Therefore, it is concluded that the most likely explanation of the failure to find a main effect for anxiety in the demand analyses is the content specificity of the stimuli. This conclusion is justified by two reasons. First, the previous research of Bentz et al. (1999) supports the content specificity explanation. Second, the fact that enough variability within the experimental demand dependent variable was present to find

the two main effects for the repeated measure makes a central tendency response bias explanation unlikely.

Neither of the two debriefing analyses found, as was hypothesized, an interaction of gender and anxiety upon game-related likelihood ratings. Again, the same two possible explanations for the null findings can be stated. Specifically, as described earlier the lack of an interaction of gender and anxiety can possibly be attributed to either (1) a central tendency response bias or (2) the content specificity hypothesis. However, it is again suggested that the content specificity explanation is the most probable.

In summary, two important findings and conclusions from the demand and debriefing ratings analyses can be reviewed. First, it can be concluded that the game-related ratings were influenced by experimental demand. However, it is important to note for the purpose of later discussion that this association was in the positive direction with an increase in demand ratings from pre to post-testing. Second, no main effect for anxiety group or interaction of gender and anxiety were found. Two possible explanations were proposed which included (1) a central tendency response bias and (2) the content specificity hypothesis.

General Discussion

It was the goal of the current study to investigate one debiasing technique, the Consider-An-Alternative procedure (Hirt & Markman, 1995), and its ability to reduce the judgmental errors which have been shown to be associated with higher levels of anxiety (Bentz & Williamson, 1998). In addition, a rival hypothesis of demand characteristics was examined as a possible explanation of any findings of the reduction of judgmental errors.

The results of the analyses for the study indicated several general conclusions. First, the presence of a judgmental bias associated with anxiety was found. This finding supports previous studies that have shown similar results (Bentz & Williamson, 1998; Bentz et al., 1999; Butler & Mathews, 1983; MacLeod & Byrne, 1996). However, the importance of this initial finding must be emphasized.

The demonstration of the judgmental bias associated with anxiety was essential to the subsequent interpretation of all results. If no bias was found, then the evaluation of the debiasing treatment and the demand characteristics rival hypothesis would have been impossible. Stated simply, if there was no bias then there would be nothing to debias. Fortunately, the bias was found supporting previous studies, and allowing the evaluation of the

debiasing procedure and the demand characteristics rival hypothesis.

Second, the debiasing of the judgmental errors associated with anxiety was demonstrated. A reduction in threat-related probability ratings of the treatment group that received the Consider-An-Alternative debiasing procedure was shown. It was concluded that this reduction in ratings was due to the treatment procedure, namely the generation of positive alternative outcomes. Furthermore, the reduction in threat ratings was equivalent for highly anxious and "normal" participants. Finally, the reduction of threat ratings in the debiasing group corresponded with an opposite trend for the control group, an increase in threat-related probability ratings. As described earlier, it is possible that this increase in probability ratings was due to the repetition of stimuli in the control procedure.

Thus, taken together the effectiveness of the debiasing procedure appeared to result in two possibly important developments. First, it is possible that when individuals are confronted with threatening situations that require predictions, the process of considering positive alternative outcomes may lead to more positive thinking. Second, the same prediction situation may also lead to less

negative and/or less ruminative thinking and prevent an exaggeration of judgmental errors.

The primary focus of the current study was to demonstrate the debiasing of judgmental errors. However, the specific process by which the debiasing occurred remains unclear. In the introduction, an availability heuristic explanation was presented in which the activation of alternative information led to decreased threat probability ratings. This explanation continues to be advocated as the most likely interpretation of the data. In addition, this explanation is supported by the similar proposals of Hirt and Markman (1995) and of Mumma and Wilson (1995).

Finally, an availability heuristic explanation fits well with the increase in threat probability ratings observed in the control group. Specifically, the repetition of the stimuli may have increased the accessibility of threat information, ultimately leading to increased probability estimates in the control group. Thus, if availability is in fact the driving mechanism of debiasing, then the findings suggest that the Consider-An-Alternative technique may not only reduce judgmental errors but also may prevent exaggerated errors that would occur with the increased accessibility of information.

It is acknowledged that the exact mechanisms by which the debiasing may occur remains to be determined. For example, one possible alternative explanation of the debiasing effect pertains to the participants' level of motivation. Specifically, the Consider-An-Alternative task may have increased the motivation of participants by maintaining a search for alternatives, a search that was not required of the control group participants. The result then may have been lower judgments on the part of the debiasing group due to increased effort as opposed to accessibility of information.

A second possible alternative explanation of the debiasing effect is demand characteristics. Specifically, it could be argued that, due to the obvious nature of the task, experimental cues within the informed consent, instructions, and debiasing procedure resulted in the participants reducing their ratings to comply with the perceived purpose of the study. This rival hypothesis was directly addressed with the addition of the six game-related experimental demand stimuli and the debriefing questions.

Experimental demand was found to be associated with an increase in probability ratings from pre to post-testing. This increase in ratings was found across all participants, regardless of treatment group, gender, or anxiety level.

Thus, it is likely that the experimental cues within the informed consent and instructions lead to the increase in probability ratings, not the experimental cues within the debiasing procedure. This conclusion can be made because no difference in game-related probability ratings was observed between the two treatment groups (control and debiasing).

As a result, demand characteristics cannot account for the reduction in threat-related probability ratings of the debiasing group. The finding of an interaction of treatment group and repeated measure upon threat-related predictions led to the conclusion that the debiasing procedure was effective in the reduction of judgmental errors. It was proposed that this debiasing effect was likely due to an availability mechanism. Demand characteristics as a rival hypothesis to this proposal has been effectively ruled out.

However, demand characteristics were shōwn to be associated with an increase in likelihood ratings. Experimental demand, therefore, continues to be a possible confound in future research especially when a similar methodology is employed. It is recommended that future experiments pay particular attention to experimental demand within the informed consent, experimental instructions, and stimuli to minimize the cues to the study's purpose.

Thus, anxiety was found to be associated with the biased judgment of future threatening events. Women were found to make higher threat-related predictions in comparison to men. The Consider-An-Alternative debiasing procedure was found to be an effective technique in the reduction of the judgment bias, regardless of level of anxiety. Finally, the reduction in judgmental errors cannot be explained by demand characteristics.

The findings from the current study have their largest potential impact in the area of techniques of cognitive-behavior therapy. Future research should extend this debiasing procedure to clinical populations and psychotherapy treatment outcome studies. It is possible that, given continued research interest and favorable results, future cognitive-behavioral treatment approaches for anxiety may include training in the consideration of alternative outcomes.

This study had certain limitations and the findings should be interpreted within the context of these limitations. First, this study used an analog sample of undergraduate students which restricts the generalization of these findings to clinical populations. Future studies should investigate the judgmental bias and the debiasing of judgmental errors associated with clinical levels of anxiety. Second, this study used a self-report methodology

which has also been utilized in several previous studies (Bentz & Williamson, 1998; Bentz et al., 1999; Butler & Mathews, 1983; MacLeod & Byrne, 1996). It is recommended that future studies use a different method of measurement of the judgmental bias. For example, the measurement of actual behavior, such as avoidance, after likelihood judgments are made by the participants. Third, the participants of this study were not followed over time to investigate if the reduction in judgmental bias was maintained. It would be desirable for future studies to evaluate the reproducibility and stability of the debiasing effect.

Finally, demand specificity, the possible differential effects that experimental demand may have on threat versus game-related ratings, was not examined. For example, differential effects that the experimental cues within the treatment procedure may have had on the threat and game-related ratings was not investigated. It is possible that the experimental cues caused an increase in probability ratings on only the game-related ratings while having no influence on the threat-related ratings. This differential specificity of experimental cues to only the demand items would then have an outcome identical to the present findings. However, the results would have been due to the unique effect that experimental demand had on the game-

related ratings because of demand specificity. It is recommended that future studies employing a similar methodology clearly establish that differential effects of experimental demand on judgment ratings has been minimized.

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Appendix A: Pre-Testing Experimental Stimuli

Directions: Please read the following paragraphs and imagine yourself in that situation. Then, rate the probability that the event listed will happen to you on the following scale, given the situation that you read. You may use any numeric value between 0% and 100%.

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

0% = The outcome has no chance of occurring.

50% = The outcome has an equal chance of occurring or not occurring.

100% = The outcome will definitely occur.

Please mark only a line to indicate your rating of the probability that the event will occur, given the situation that was presented. You may draw your line at any point on the scale provided. **DO NOT WRITE A NUMBER**

Example: Your car's engine has not been running very well over the last month and it has been very hard to start at times, but you have been unable to take it to a mechanic to have it checked.

What is the probability that your car will break down today?

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

1. It has been raining very hard and windy all day and there has been a flood and tornado advisory reported on the news. Your home is built in a low area with a history of water and wind damage in the past.

What is the probability that your home will sustain damage from the storm?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. You are in a large auditorium with very few other people watching a movie. At the end of the movie, people begin to move toward the exits.

What is the probability that you will be injured trying to leave the auditorium?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. You are passing one of your classes but it is early in the semester. There are several more tests remaining for your grade to change.

What is the probability that you will fail the class?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. Late at night, you are walking to your car in a part of town that is known for a high crime rate. Your car is parked in an area that has very poor lighting.

What is the probability that you will be mugged?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. It has been a sunny day with very few clouds in the sky. You live in a home that has never had a history of water or wind damage from a storm.

What is the probability that your home will avoid damage from the storm?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. Late at night, you are driving on a highway that is totally deserted. One of your tires blows out and you pull off the road to check for damage.

What is the probability that you will be stranded on the highway?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. You have just graduated from college and taken a job that will move you away from your home town. This job will take you to a city with a low crime rate and you will be living in an safe part of the town.

What is the probability that you will avoid becoming a crime victim?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. You have a job that you enjoy but the company is having financial problems and will lay off several employees in the near future.

What is the probability that you will keep your job?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. You are riding a bicycle down a large hill when you realize that the brakes of the bike are not working and a sharp turn is just ahead.

What is the probability that you will avoid wrecking the bicycle?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

10. You are driving to a meeting across town, but you don't expect to be late. The weather is fine and traffic is average.

What is the probability that you will be in a car accident?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

11. You have just graduated from college and taken a job that will move you away from your home town. This job will take you to a city with a high crime rate and you will be living in an unsafe part of the town.

What is the probability that you will become a crime victim?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

12. You have a job that you enjoy and the company is financially having no problems. There is little risk that the company will lay off any employees in the near future.

What is the probability that you will lose your job?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

13. During the day, you are walking to your car in a part of town that is familiar to you. Your car is parked in an area that often has others around, but at this time you do not see anyone.

What is the probability that you will avoid being mugged?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

14. During the day, you are driving on a highway that has few other cars. You know that one of your tires has a slow air leak, but you checked the air pressure in the morning.

What is the probability that you will avoid being stranded on the highway?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

15. You are failing one of your classes and it is already half way through the semester. There are only two tests remaining to pull your grade up to a passing level.

What is the probability that you will pass the class?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

16. You are in a large auditorium with hundreds of people watching a movie. You have a faint smell of smoke when an alarm goes off and people begin running to the exits.

What is the probability that you will avoid being injured trying to leave the auditorium?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

17. You are out on the ocean, deep sea fishing with some friends when a large storm begins to roll in. You try to start the engine, but mechanical problems prevent the engine from starting.

What is the probability that you will be lost at sea?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

18. You are late for an important meeting across town so you are driving above the speed limit. It starts to rain heavily and the traffic around you is hard to see clearly.

What is the probability that you will avoid a car accident?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

19. You are riding a bicycle on a relatively flat road with no other cars or bicycles in sight. The brakes of your bike are working just fine.

What is the probability that you will wreck the bicycle?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

20. You are out on the ocean, deep sea fishing with some friends and it is sunny with few clouds in the sky. Your boat has never had any mechanical problems.

What is the probability that you will get home safe?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix B: Post-Testing Experimental Stimuli

Directions: Please read the following paragraphs and imagine yourself in that situation. Then, rate the probability that the event listed will happen to you on the following scale, given the situation that you read. You may use any numeric value between 0% and 100%.

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

0% = The outcome has no chance of occurring.

50% = The outcome has an equal chance of occurring or not occurring.

100% = The outcome will definitely occur.

Please mark only a line to indicate your rating of the probability that the event will occur, given the situation that was presented. You may draw your line at any point on the scale provided. **DO NOT WRITE A NUMBER**

Example: Your car's engine has not been running very well over the last month and it has been very hard to start at times, but you have been unable to take it to a mechanic to have it checked.

What is the probability that your car will break down today?

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

1. You are driving to a meeting across town, but you don't expect to be late. The weather is fine and traffic is average.

What is the probability that you will avoid being in a car accident?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. You are riding a bicycle down a large hill when you realize that the brakes of the bike are not working and a sharp turn is just ahead.

What is the probability that you will wreck the bicycle?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. During the day, you are driving on a highway that has few other cars. You know that one of your tires has a slow air leak, but you checked the air pressure in the morning.

What is the probability that you will be stranded on the highway?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. You are in a large auditorium with hundreds of people watching a movie. You have a faint smell of smoke when an alarm goes off and people begin running to the exits.

What is the probability that you will be injured trying to leave the auditorium?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. You have a job that you enjoy but the company is having financial problems and will lay off several employees in the near future.

What is the probability that you will lose your job?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. You are out on the ocean, deep sea fishing with some friends when a large storm begins to roll in. You try to start the engine, but mechanical problems prevent the engine from starting.

What is the probability that you will get home safe?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. You have a job that you enjoy and the company is financially having no problems. There is little risk that the company will lay off any employees in the near future.

What is the probability that you will keep your job?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. Late at night, you are driving on a highway that is totally deserted. One of your tires blows out and you pull off the road to check for damage.

What is the probability that you will avoid being stranded on the highway?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. You are riding a bicycle on a relatively flat road with no other cars or bicycles in sight. The brakes of your bike are working just fine.

What is the probability that you will avoid wrecking the bicycle?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

10. You are out on the ocean, deep sea fishing with some friends and it is sunny with few clouds in the sky. Your boat has never had any mechanical problems.

What is the probability that you will be lost at sea?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

11. You are failing one of your classes and it is already half way through the semester. There are only two tests remaining to pull your grade up to a passing level.

What is the probability that you will fail the class?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

12. During the day, you are walking to your car in a part of town that is familiar to you. Your car is parked in an area that often has others around, but at this time you do not see anyone.

What is the probability that you will be mugged?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

13. It has been raining very hard and windy all day and there has been a flood and tornado advisory reported on the news. Your home is built in a low area with a history of water and wind damage in the past.

What is the probability that your home will avoid sustaining damage from the storm?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

14. You have just graduated from college and taken a job that will move you away from your home town. This job will take you to a city with a low crime rate and you will be living in an safe part of the town.

What is the probability that you will be a crime victim?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

15. You are late for an important meeting across town so you are driving above the speed limit. It starts to rain heavily and the traffic around you is hard to see clearly.

What is the probability that you will be in a car accident?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

16. Late at night, you are walking to your car in a part of town that is known for a high crime rate. Your car is parked in an area that has very poor lighting.

What is the probability that you will avoid being mugged?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

17. You have just graduated from college and taken a job that will move you away from your home town. This job will take you to a city with a high crime rate and you will be living in an unsafe part of the town.

What is the probability that you will avoid becoming a crime victim?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

18. It has been a sunny day with very few clouds in the sky. You live in a home that has never had a history of water or wind damage from a storm.

What is the probability that your home will sustain damage from the storm?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

19. You are passing one of your classes but it is early in the semester. There are several more tests remaining for your grade to change.

What is the probability that you will pass the class?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

20. You are in a large auditorium with very few other people watching a movie. At the end of the movie, people begin to move toward the exits.

What is the probability that you will avoid being injured trying to leave the auditorium?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix C: Consider-An-Alternative Debiasing Stimuli

Directions: Please read the following paragraphs and imagine yourself in that situation. Then, generate three possible ways in which the situation may end in a **POSITIVE** outcome. Give enough detail to your situational outcome to clearly explain how the event will end. Your three alternative outcomes for the situation should all be different and **POSITIVE** in some way.

Example: Your car's engine has not been running very well over the last month and it has been very hard to start at times, but you have been unable to take it to a mechanic to have it checked.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

1. You are riding a bicycle on a relatively flat road with no other cars or bicycles in sight. The brakes of your bike are working just fine.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

2. It has been raining very hard and windy all day and there has been a flood and tornado advisory reported on the news. Your home is built in a low area with a history of water and wind damage in the past.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

3. You have just graduated from college and taken a job that will move you away from your home. This job will take you to a city with a high crime rate and you will be living in an unsafe part of the town.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

4. During the day, you are walking to your car in a part of town that is familiar to you. Your car is parked in an area that often has others around, but at this time you do not see anyone.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

5. You are riding a bicycle down a large hill when you realize that the brakes of the bike are not working and a sharp turn is just ahead.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

6. You are in a large auditorium with hundreds of people watching a movie. You have a faint smell of smoke when an alarm goes off and people begin running to the exits.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

7. You are out on the ocean, deep sea fishing with some friends and it is sunny with few clouds in the sky. Your boat has never had any mechanical problems.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

8. During the day, you are driving on a highway that has few other cars. You know that one of your tires has a slow air leak, but you checked the air pressure in the morning.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

9. Late at night, you are driving on a highway that is totally deserted. One of your tires blows out and you pull off the road to check for damage.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

10. You have a job that you enjoy but the company is having financial problems and will lay off several employees in the near future.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

11. You are out on the ocean, deep sea fishing with some friends when a large storm begins to roll in. You try to start the engine, but mechanical problems prevent the engine from starting.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

12. You have just graduated from college and taken a job that will move you away from your home town. This job will take you to a city with a low crime rate and you will be living in an safe part of the town.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

13. You are passing one of your classes but it is early in the semester. There are several more tests remaining for your grade to change.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

14. You are failing one of your classes and it is already half way through the semester. There are only two tests remaining to pull your grade up to a passing level.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

15. It has been a sunny day with very few clouds in the sky. You live in a home that has never had a history of water or wind damage from a storm.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

16. Late at night, you are walking to your car in a part of town that is known for a high crime rate. Your car is parked in an area that has very poor lighting.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

17. You have a job that you enjoy and the company is financially having no problems. There is little risk that the company will lay off any employees in the near future.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

18. You are late for an important meeting across town so you are driving above the speed limit. It starts to rain heavily and the traffic around you is hard to see clearly.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

19. You are in a large auditorium with very few other people watching a movie. At the end of the movie, people begin to move toward the exits.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

20. You are driving to a meeting across town, but you don't expect to be late. The weather is fine and traffic is average.

Generate three different **POSITIVE** ways in which this situation may end.

(1) _____

(2) _____

(3) _____

Appendix D: Control Stimuli

Directions: Please read the following paragraphs and imagine yourself in that situation. Then, please indicate the nouns and verbs within the paragraphs by writing the words in the spaces provided below. There may be more or less of the parts of speech present within the paragraphs in comparison to spaces provided. However, you need to only indicate a total of three nouns and verbs in the spaces provided.

Example: Your car's engine has not been running very well over the last month and it has been very hard to start at times, but you have been unable to take it to a mechanic to have it checked.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

1. You are riding a bicycle on a relatively flat road with no other cars or bicycles in sight. The brakes of your bike are working just fine.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

2. It has been raining very hard and windy all day and there has been a flood and tornado advisory reported on the news. Your home is built in a low area with a history of water and wind damage in the past.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

3. You have just graduated from college and taken a job that will move you away from your home. This job will take you to a city with a high crime rate and you will be living in an unsafe part of the town.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

4. During the day, you are walking to your car in a part of town that is familiar to you. Your car is parked in an area that often has others around, but at this time you do not see anyone.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

5. You are riding a bicycle down a large hill when you realize that the brakes of the bike are not working and a sharp turn is just ahead.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

6. You are in a large auditorium with hundreds of people watching a movie. You have a faint smell of smoke when an alarm goes off and people begin running to the exits.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

7. You are out on the ocean, deep sea fishing with some friends and it is sunny with few clouds in the sky. Your boat has never had any mechanical problems.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

8. During the day, you are driving on a highway that has few other cars. You know that one of your tires has a slow air leak, but you checked the air pressure in the morning.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

9. Late at night, you are driving on a highway that is totally deserted. One of your tires blows out and you pull off the road to check for damage.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

10. You have a job that you enjoy but the company is having financial problems and will lay off several employees in the near future.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

11. You are out on the ocean, deep sea fishing with some friends when a large storm begins to roll in. You try to start the engine, but mechanical problems prevent the engine from starting.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

12. You have just graduated from college and taken a job that will move you away from your home town. This job will take you to a city with a low crime rate and you will be living in an safe part of the town.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

13. You are passing one of your classes but it is early in the semester. There are several more tests remaining for your grade to change.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

14. You are failing one of your classes and it is already half way through the semester. There are only two tests remaining to pull your grade up to a passing level.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

15. It has been a sunny day with very few clouds in the sky. You live in a home that has never had a history of water or wind damage from a storm.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

16. Late at night, you are walking to your car in a part of town that is known for a high crime rate. Your car is parked in an area that has very poor lighting.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

17. You have a job that you enjoy and the company is financially having no problems. There is little risk that the company will lay off any employees in the near future.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

18. You are late for an important meeting across town so you are driving above the speed limit. It starts to rain heavily and the traffic around you is hard to see clearly.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

19. You are in a large auditorium with very few other people watching a movie. At the end of the movie, people begin to move toward the exits.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

20. You are driving to a meeting across town, but you don't expect to be late. The weather is fine and traffic is average.

Please indicate the nouns and verbs within the paragraph above by writing the words in the spaces provided below.

Nouns	Verbs
(1) _____	(1) _____
(2) _____	(2) _____
(3) _____	(3) _____

Appendix E: Pre-Testing Experimental Demand Stimuli

1. You are playing on a softball team that is sponsored by your job. You have a record of 3 wins and 3 losses, and today you are playing an opposing team with a similar record.

What is the probability that your team will win the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. You are playing a game of volleyball at a summer picnic with a group of friends.

What is the probability that your team will win the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. You are playing a game of Monolopy at a holiday party with your family and friends.

What is the probability that you will win the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. You are playing a game of cards at your weekly poker match with a group of six poker players.

What is the probability that you will lose the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. While at the park, you get picked to play some basketball on an outside court with some people that you do not know.

What is the probability that your team will lose the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. You are at a friend's house playing a game of Trivial Pursuit. There are a total of six people playing the game.

What is the probability that you will lose the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix F: Post-Testing Experimental Demand Stimuli

1. You are playing on a softball team that is sponsored by your job. You have a record of 3 wins and 3 losses, and today you are playing an opposing team with a similar record.

What is the probability that your team will lose the game?

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

2. You are playing a game of volleyball at a summer picnic with a group of friends.

What is the probability that your team will lose the game?

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

3. You are playing a game of Monolopy at a holiday party with your family and friends.

What is the probability that you will lose the game?

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

4. You are playing a game of cards at your weekly poker match with a group of six poker players.

What is the probability that you will win the game?

```
|----|----|----|----|----|----|----|----|----|----|
0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
```

5. While at the park, you get picked to play some basketball on an outside court with some people that you do not know.

What is the probability that your team will win the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. You are at a friend's house playing a game of Trivial Pursuit. There are a total of six people playing the game.

What is the probability that you will win the game?

|----|----|----|----|----|----|----|----|----|----|
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix G: Debriefing Questions

Directions: Please read the following three questions and circle the answer that most closely describes your opinion.

1. In your opinion, what was the purpose of the experiment?

   A. The purpose of the experiment was for me to increase my probability ratings of the likelihood of future events.

   B. The purpose of the experiment was for me to decrease my probability ratings of the likelihood of future events.

   C. The purpose of the experiment was for me to make no changes in my probability ratings of the likelihood of future events.

   D. I don't know the purpose of the experiment.

2. In your opinion, was there any part of the experiment that suggested to you that you should change your outcome probability ratings? If so, which part of the experiment gave you this suggestion to change your probability ratings?

   A. The part which asked me to write several alternative outcomes to the situations.

   B. The part which asked me to identify the nouns and verbs in the written situations.

   C. The part which asked me to make the outcome probability ratings for a second time.

   D. There was no part of the experiment that suggested to me that I should change my outcome probability ratings.

3. Did you notice a procedure within the experiment which suggested to you that the purpose of the experiment was to change your probability ratings because you were considering alternative ways that the situations may end?

A. Yes

B. No

Appendix H: Informed Consent

1. Study Title:	The Debiasing of Judgmental Errors Associated with Anxiety
2. Performance Site:	Texas Wesleyan University
3. Investigator:	The following investigator is available for questions about this study, M-F, 8:00 am - 5:00 pm. Bret G. Bentz M.A., (817) 732-4231
4. Purpose of the Study:	The purpose of the study to investigate the prediction of future events and errors that may occur in these predictions. The study will investigate several questions concerning the reduction of judgmental errors that occur in differing levels of anxiety.
5. Subject Inclusion:	There are no inclusion or exclusion criteria for participation in this study. All students recruited through the Department of Psychology will be able to participate.
6. Number of Subjects:	400
7. Study Procedures:	The study will include the completion of several questionnaires and will take approximately 45 minutes. First, you will be asked to complete a short demographic information sheet and a questionnaire designed to assess you current level of anxiety. Next, you will read several hypothetical situations and make ratings as to the probability of certain outcomes. Next, depending on your randomized group, you will again read several similar hypothetical situations

and either record the parts of speech in the paragraph or generate alternative outcomes. Finally, you will read several situations and make probability ratings a second time followed by several debriefing questions.

8. Benefits: The benefits for your participation in this study is the advancement of the understanding of judgmental errors associated with anxiety.

9. Risks: There are no potential risks for physical or social harm for your participation. Psychological risk is minimal and only includes the inadvertent release of sensitive information found in the second questionnaire. Every effort will be made to maintain the confidentiality of your study records. Data will be kept in secure locations to which only the investigator has access.

10. Right to Refuse: Subjects may choose not to participate or to withdraw from the study at any time without penalty or loss of any benefit to which you are entitled.

11. Privacy: The results of the study may be published, but no names or identifying information will be included in the publication. Subject identity will remain confidential unless disclosure is required by law.

12. Signatures:

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Charles E. Graham, Chairman, LSU Institutional Review Board, (225) 388-1492. I agree to participate in the study described above and acknowledge the researchers' obligation to provide me with a copy of this consent form.

_____ _____-_____-_____

Participant's Signature Date

_____

Participant's Name (Please Print)

Vita

Bret G. Bentz completed his graduate studies for the degree of Doctor of Philosophy in clinical psychology at Louisiana State University in Baton Rouge, Louisiana. He is originally from Pittsburgh, Pennsylvania, where he received the degree of Bachelor of Science in psychology from Carnegie-Mellon University. After his undergraduate education, Dr. Bentz spent two years working at the Western Psychiatric Institute and Clinic at the University of Pittsburgh before leaving for his graduate studies at Louisiana State University. In addition, he completed his clinical psychology internship at the University of North Texas Health Sciences Center in Fort Worth, Texas. He will be starting on January 1, 2001, a one year post-doctoral fellowship at the University of North Texas Health Sciences Center in Fort Worth, Texas.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Bret G. Bentz

Major Field: Psychology

Title of Dissertation: The Debiasing of Judgmental Errors Associated with Anxiety

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

11/21/00